NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Line Markers for Mains and Transmission Lines**	Standard Number: **GS 1720.010(KY)**
Supersedes: 01/01/2013		Page 1 of 7

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
	☑ CKY	☐ COH
	☐ CMA	☐ CPA

REFERENCE 49 CFR Part 192.707; KY 807 KAR 5:022 SECTION 14

1. GENERAL

Pipeline markers are installed for the following reasons:

a. to warn excavators of the presence of pipelines,

b. to inform the general public and emergency services of the presence of pipelines,

c. to provide a telephone number to obtain more accurate location information,

d. to allow persons to report indications of problems relating to the safety of a pipeline, and

e. to identify the approximate location of facilities for the performance of company activities.

2. PLACEMENT OF LINE MARKERS

2.1 Buried Pipelines

Except as noted in Section 2.2, a line marker must be placed and maintained as close as practical over each buried distribution main and transmission line:

a. at each crossing of a public road and railroad, and

b. wherever necessary to identify the location of the distribution main or transmission line to reduce the possibility of damage or interference.

Consideration should also be given to installing line markers when a main or transmission line crosses or lies in close proximity to an area where the potential for future excavation or damage is likely. Typical examples include the following locations.

a. Drainage areas (such as flood-prone watercourses).

b. Irrigation ditches and canals subject to periodic excavations for cleaning out or deepening.

c. Drainage ditches subject to periodic grading including those along roads.

d. Agricultural areas in which deep plowing or deep-pan breakers are employed.

e. Active drilling or mining areas.

f. Waterways or bodies of water subject to dredging or shipping activities.

g. Industrial or plant areas where excavating, earth moving, and heavy equipment operating activities are routine.

If line markers are installed, they should be placed where there is direct line of sight to the next line marker. The maximum spacing between line markers should be approximately 500 feet, if practicable.

2.2 Exceptions for Buried Distribution Mains and Transmission Lines

Line markers are not required for buried pipelines as follows:

a. offshore,

b. at crossings of waterways or other bodies of water, except as noted in Section 2.4,

c. under waterways or other bodies of water,

d. for distribution mains, in Class 3 and 4 locations (i.e., more populated areas having 46 or more buildings intended for human occupancy near the main) where a damage prevention program is in effect, or

e. for transmission lines, in Class 3 and 4 locations where placement of a line marker is impractical.

NOTE: Questions regarding class locations may be directed to Engineering. Class location definitions can be found in GS 1640.010 “Class Location Determination for Transmission Lines.”

2.3 Pipelines Above Ground

Line markers must be placed and maintained along each section of a main and transmission line that is located above ground in an area accessible to the public. Either permanent line markers or decals applied directly to the pipe shall be utilized.

2.4 Navigable Waterway Crossings

At navigable waterways, it is recommended that two line markers be installed; one on each bank. Each line marker should have a rectangular sign that is visible from midstream. As a guideline, the legibility distance in feet is 40 times the letter height in inches. The stroke of the letter should be 1/4 of the height.

2.4.1 Kentucky Requirements

A line marker shall be installed at each navigable waterway. Each line marker at a navigable waterway shall have the following characteristics.

A rectangular sign with a narrow strip along each edge, colored international orange, and the area between lettering on the sign and boundary strips colored white.

Written on the sign in block style, black letters:

The word “Warning,” “Caution,” or “Danger,” followed by the words “Do NOT Anchor or Dredge” and the words, “Gas (or name of gas transported Pipeline) Crossing; and

The name of the Company and telephone number (including area code) where the Company can be reached at all times.

In overcast daylight, the sign is visible and the writing required is legible, from approaching or passing vessels that may damage or interfere with the pipeline.

2.5 Aerial Markers

Aerial markers, when used, should be located at strategic locations readily visible from patrol aircraft. Where permanent fence posts at pipeline right-of-way crossings are painted by the Company, the top 12 inches shall be yellow. The top points of Company facilities may be painted yellow to serve as additional means of aerial identification.

2.6 Additional Considerations for Transmission Lines

Consider the installation of line markers at designated locations along the right-of-way, where practical, and wherever the party exerting control over the surface use of the land will permit such installations. Possible locations for line marker placement include the following locations.

a. Fence lines.
b. Angle points (i.e., bends and changes in pipeline direction).
c. Lateral take-off points.
d. Stream crossings (including bridges).
e. Where necessary to identify pipeline locations for patrols and leak surveys.
f. Where necessary for visibility of line markers in both directions.
g. Where it is difficult to define pipelines located in private or public easements.

Other methods of indicating the presence of the line may be used where the use of conventional markers is not feasible, such as stenciled markers, cast monument plaques, signs, or devices flush mounted in curbs, sidewalks, streets, building facades or other appropriate locations.

NOTE: Flush mounted (i.e., grade level) line markers are not large enough to meet the lettering sizing requirements of the minimum federal safety standards (see Section 3 below). Therefore, when used to mark the location of a transmission line, flush mounted line markers shall only be used in areas expressly excepted from line marking requirements and lettering size requirements. These areas include heavily developed urban areas (lettering size exception) or where transmission line markers are not required (e.g., buried transmission lines in Class 3 or 4 locations where placement of a line marker is impractical). See Section 2.2 above.

2.7 Additional Considerations for Distribution Mains

While line markers are not normally practical for distribution systems, consider the installation where special problems exist, which are not managed with alternate locating options (e.g., buried electronic markers), such as the following.

a. Difficult to locate pipelines.

b. Pipelines with excessive cover.

c. Locations congested with other underground utilities.

d. Where it is difficult to define pipelines located in private or public easements.

Where post style line markers are not practical (e.g., certain residential areas), flush mounted line markers may be considered.

NOTE: Flush mounted line markers are not large enough to meet the lettering sizing requirements established by the minimum federal safety standards (see Section 3 below). Therefore, when used to mark the location of a distribution main, flush mounted line markers shall only be used in areas expressly excepted from line marking requirements and lettering size requirements. These areas include heavily developed urban areas (lettering size exception) or where line markers for distribution mains are not required (e.g.., in Class 3 and 4 locations, where a damage prevention program is in effect). See Section 2.2 above.

2.8 Temporary Markers During Active Construction

The installation of temporary line markers should also be considered in areas of

construction activity during the period that construction is in progress. Areas for consideration might include along highways, strip mines, and major excavations. Examples of construction activities to consider include the following.

a. Road improvement projects where Company facilities do not require relocation.

b. Road improvement projects where the Company has relocated facilities for the project.

c. New business projects where other utilities are expected to construct facilities after the Company's installation has been completed.

2.9 Other Locations

In addition to the previously mentioned areas, line markers may be placed at the following locations:

a. where a main or transmission line crosses property line fences, usually in rural areas,

b. where a main or transmission line crosses a ditch, stream or other non-navigable waterway,

c. in utility easements,

d. at changes in direction of a main, where practical,

e. at buried valve locations, and

f. at test station locations.

3. MARKER SPECIFICATIONS

Markers may be, but are not limited to signs, decals, and fence posts. Lettering on the markers for items (a) and (b) below:

1. must be written on a background of sharply contrasting color and

2. must be at least 1” high and ¼” wide stroke, except for gas pipeline markers in heavily developed urban areas.

The message on the line marker must include:

a. The words “WARNING”, “CAUTION” or “DANGER”

b. The words “GAS PIPELINE” or “NATURAL GAS PIPELINE” or equivalent

c. The Company name

d. The Company’s 24-hour emergency notification telephone number

The message should also include the universal symbol for “no digging” and legal warning,

along with the national one-call “811” number and the applicable state’s one-call system number. See Exhibit A for an example.

4. MAINTENANCE

Line markers found to be in need of maintenance shall either be repaired or replaced and decals updated if necessary.

5. RECORDS

New installations of line markers (e.g., post style, flush mounted) that house tracer wire used to locate plastic pipeline (i.e., tracer wire station or TWS) shall be mapped in the Company’s geographic information system (GIS).

Existing tracer wire stations (TWS) may be mapped in the Company’s GIS by submitting a map revision in accordance with GS 2610.040 “Map Revision.”

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Gas Standard

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EXHIBIT A

NiSource
Distribution Operations

Gas Standard

Effective Date: 06/01/2016	**Transmission Line Field Repair**	Standard Number: **GS 1730.010**
Supersedes: 07/01/2014		Page 1 of 24

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.709, 192.711, 192.713, 192.715, 192.717, 192.719, ASME B31.8, Section 851.4; PRCI Updated Pipeline Repair Manual, Revision 6; ANSI/API Specification 5L

1. GENERAL

This procedure defines the general requirements for repairs to in-service transmission lines for any damage that impairs the pipeline's serviceability and is intended for use where normal repairs are required and may not cover all situations. Consult with the Pipeline Safety and Compliance and/or the local Pipeline Integrity Management Team when encountering a condition not addressed within this procedure.

Refer to the Company's Integrity Management Program when making repairs on transmission lines.

This procedure does not apply to imperfections found during construction of new facilities. Refer to GS 3010.010 "Repair of Steel Pipe" for guidance for required repairs found prior to the pipeline being placed in-service.

Systems Operations (Columbia) or Gas Measurement & Transmission (NIPSCO) in consultation with Pipeline Safety and Compliance is responsible for selecting the repair method.

Each segment of pipeline that becomes unsafe, i.e., it has been found to be damaged or deteriorated to the extent that its serviceability is impaired (see guidance in Section 3 below) or it has developed leakage classified as Grade 1, must be repaired, or removed from service. Refer to GS 1714.010 "Leakage Classification and Response" for leakage response requirements for all leak classifications.

Replacing a section of pipeline is always an acceptable remediation technique. Pipe replacement is not addressed in this procedure. As such, Construction standards (Series 3000) and other applicable standards shall be consulted when replacement is used as a method to remediate a defect.

Whenever pipe coating has been disturbed or found to be inadequate, coating repair shall be completed in accordance with GS 1420.035 "Coating Repair Methods for Mill Applied Coatings."

Certain damage and imperfections may constitute a reportable safety-related condition. Refer to GS 1020.010 “Safety-Related Conditions - Recognition, Notification, and Reporting” for additional guidance.

The Company shall ensure that reasonable precautions are taken to protect the employees and general public. This includes taking practical steps to keep non-essential personnel and the public outside the work area during the repair process. Make safety the primary consideration when evaluating a pressurized pipeline. Information that should be considered includes the condition of the pipeline and the proximity of the pipeline to buildings, property, roads and any place where people live or gather.

2. PRESSURE REDUCTION

A pressure reduction is required if an evaluation of a defect/damage determines that the operating pressure exceeds the safe pressure level. A reduction in operating pressure should be considered before excavating the pipeline to assess the situation and/or make a repair. Engineering and Gas Control, if applicable, should be consulted when planning to reduce operating pressure.

If the extent of the damage is known or after the extent of the damage is assessed, the RSTRENG® or ASME/ANSI B31G method or an alternative equivalent method of calculating the remaining strength shall be used, if applicable, to calculate the safe allowable pressure. Refer to GS 1460.020 “Corrosion Remedial Measures – Transmission Lines.”

If the defect or damage affects the pipeline serviceability (see Section 3 below), the operating pressure shall be lowered to the safe allowable pressure or less; or alternatively if a safe allowable pressure cannot be calculated or the extent of the damage cannot be assessed, then the pressure shall be lowered to 80% or less of the operating pressure at the time the condition was discovered, with the following exception.

a. If subsequent damages are found during a current pressure reduction, another pressure reduction is not required, provided that the safe allowable pressure (calculated by RSTRENG® or ASME/ANSI B31G, if applicable) is not exceeded, **and**

b. it can be reasonably determined that the damage occurred prior to the current pressure reduction.

These recommendations also apply when there are external factors that may contribute to pipe stress such as settlement, soil movement, or pipeline support factors.

The pressure reduction shall be considered temporary and shall remain lowered until a permanent repair, abandonment, or replacement is completed. If the pressure reduction is a result of a defect found as a part of a Pipeline Integrity Assessment, and if the pressure reduction exceeds 365 days, notification must be made to the Pipeline and Hazardous Materials Safety Administration (PHMSA) and applicable State agency which includes technical justification that the continued operation at the reduced pressure will not

jeopardize the integrity of the pipeline.

A permanent reduction in Maximum Allowable Operating Pressure (MAOP) may be considered, where practical, if a repair, abandonment, or replacement is not feasible.

3. DEFECTS AFFECTING SERVICEABILITY

Defects that affect or may affect serviceability require repair, abandonment, or replacement. For other defects not included in the list below, or when different kinds of defects interact, consult with the local Pipeline Integrity Management Team for guidance. Based on the defect type and/or interaction of defects a specific response may be required. Refer to IMP 6-18 “Defect Classification and Response Schedule,” Section 4.1 or for NIPSCO, IMP 05-001 “Addressing Conditions Found During an Integrity Assessment.”

A stress concentrator is a gouge, grove, arc burn or crack on a pipeline. A stress concentrator may be isolated or located within the perimeter of another defect such as a dent

3.1 Gouges

All **gouges** (including grooves, notches, scrapes and scratches) are considered injurious and may affect serviceability. All gouges, grooves, notches, scrapes, and scratches, regardless of size, shall have stress concentrators removed by grinding and assessed as outlined in this document.

3.2 Arc Burns

Arc burns that include metal loss, cracking, hard and/or soft spots, or stress concentrators may affect serviceability.

3.3 Cracks

All **cracks**, regardless of size, affect serviceability.

3.4 Defective Welds

Defective welds may affect serviceability. A girth weld shall not be considered defective if it is visually acceptable and passed the weld inspection requirements at the time it was made.

3.5 Dents

The depth of a **dent** is measured as the gap between the lowest point of the dent and a prolongation of the original contour of the pipe.

Plain dents are dents that vary smoothly and do not contain creases, mechanical damage, corrosion, arc burns, girth or seam welds. Plain dents are defined as

injurious and affecting serviceability if they exceed a depth of 6% of the nominal pipe diameter. In evaluating plain dents, the need for the segment to be able to safely pass an internal inspection or cleaning device shall also be considered. Any dents that are not acceptable for this purpose should be removed prior to passing these devices through the segment, even if the dent is not injurious.

A dent that has any indication of metal loss, cracking or a stress concentrator are injurious and affect serviceability. A dent with corrosion requires additional evaluation and may be considered injurious and affecting serviceability.

Dents that affect girth or seam welds are considered injurious and affect serviceability.

3.6 Corrosion

Localized corrosion pitting does not always affect a pipe's serviceability.

For corrosion defects, **RSTRENG®** or ASME/ANSI B31G may be used to determine if the serviceability of the pipe is affected and to determine the safe operating pressure of the pipe segment. If necessary, use the repair methods in Table 2.

General corrosion should be considered as affecting the pipeline's serviceability.For corrosion defects, **RSTRENG®** or ASME/ANSI B31G may be used to determine if the serviceability of the pipe is affected and to determine the safe operating pressure of the pipe segment. If necessary, use the repair methods in Table

A leak due to corrosion affects serviceability.

4. PRECAUTIONS WITH PRE-1970 PIPE

Concerns with pre-1970 electric resistance welded (ERW) or electric fusion welded (EFW) pipe include that the seam may have low toughness and the seam may contain imperfections. Additionally, an ERW seam may be difficult to locate. Therefore, grinding of the seam area should not be performed unless nondestructive examinations are completed to find the seam and verify that it is free of imperfections. Refer to Section 6.7 "Grinding" for more guidance on this repair method.

5. REPAIR METHOD SELECTION

Depending on the type of damage there may be more than one acceptable method to repair a damaged pipe. Systems Operations (Columbia) or GM&T (NIPSCO) in consultation with Pipeline Safety and Compliance is responsible for selecting the repair method.

Refer to Section 6 for additional information on the application and installation for each type of approved repair method.

The following sections provide guidance for evaluating certain defects and selecting an adequate repair method. The application of other methods that reliable engineering tests

and analyses has shown to permanently restore the serviceability of the pipe may also be used.

5.1 Inspection for Cracks

For defects other than corrosion, prior to repair, the surface in the area of the defect shall be inspected using a nondestructive surface examination method capable of detecting cracks (e.g., magnetic particle, dye penetrant) to determine the appropriate repair method.

5.2 Temporary Repairs

Temporary repairs may be made provided the temporary repair is able to safely constrain the condition until a permanent repair is made. Temporary repairs shall be replaced with a permanent repair within one (1) year unless additional time is approved by the VP & General Manager. The timeline for remedial action will depend upon the specific situation, but must be established to ensure that the temporary action has a permanent repair solution documented in the Company's work management system or equivalent, with a specific completion date (e.g., commit date).

NOTE: If the temporary repair involves a pressure reduction that will extend past 365 days, refer to Section 2 for required notifications.

5.3 Field Repair of Defective Girth Welds

Girth welds suspected of being defective shall be non-destructively evaluated to verify the defect before repairing or removing. If the girth weld is confirmed to be defective, and it is feasible to take the segment out of service follow bullets a through d below:

a. Girth welds with cracks greater than 8% of the weld length shall be cut out. Table 1 gives the length for each pipe diameter corresponding to 8% of a circumferential weld.

b. Defective girth welds may be repaired using an applicable qualified welding procedure.

c. Defective girth welds may be cut out and replaced.

d. Defective girth welds may be repaired with a type B sleeve. See Sections 6.2 and 6.4.

If the girth weld is defective and it is not feasible to take the segment out of service, the weld may be repaired by welding only if the following three (3) conditions exist:

1. The weld is not leaking.

2. The pressure is reduced so that the hoop stress is no greater than 20% of the Specified Minimum Yield Strength (SMYS) of the pipe.

3. Grinding can be completed leaving at least 1/8 inch thickness of the original weld.

Otherwise, a full encirclement welded split sleeve that accommodates the defective girth weld shall be installed.

Table 1

Nominal Pipe Diameter	8% of Circumferential Weld Length
4”	1-1/8”
6”	1-5/8”
8”	2-1/8”
10”	2-11/16”
12”	3-3/16”
14”	3-1/2”
16”	4”
18”	4-1/2”
22”	5-1/2”
24”	6”
30”	7-1/2”

5.4 Repair of Leaks

When there is a gas leak, take caution to ensure the site is safe, including dispersing the gas to reduce the chance of fire or explosion. This could include lowering the pressure or blowing the pipeline down.

Permanent repairs of a leak must be made by one of the following methods:

a. if the pipeline can be taken out of service, removing the leak by cutting out and replacing a cylindrical piece of pipe and replacing with pipe of equal or greater strength,

b. installing a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) rated for the appropriate design pressure,

c. if the leak is due to a corrosion pit and the pipeline operates below 40% SMYS, install a properly designed bolt-on leak clamp (see Section 6.5 for additional information),

d. if the leak is on a submerged pipeline in inland navigable waters, mechanically apply a full encirclement split sleeve of appropriate design,

e. installing a welded Type B (see Section 6.2) full encirclement split sleeve of the appropriate design,if the pipeline can be taken out of service, removing the leak by cutting out and replacing a cylindrical piece of pipe and replace with pipe of equal or greater strength,

f. applying a method that reliable engineering tests and analyses show can permanently restore the serviceability of the pipe,

g. using an approved method of maintenance or repair on other types of fittings (e.g., greasing a valve, tightening tapping tee cap).

5.5 External Corrosion: Non-Leaking

The wall loss shall be measured with an appropriate tool (e.g., ultrasonic thickness gauge, profile gauge, pit gauge) by verifying the nominal wall thickness of a section without corrosion and by determining the maximum depth of pitting. The axial length of corrosion shall also be measured. A six (6) times the wall thickness axial separation and one (1) inch circumferential separation interaction rule shall be applied. See Exhibit B for additional information.

Where the maximum wall loss due to external corrosion is greater than 80%, the pipe shall be repaired according to Table 2 below. If the maximum wall loss is 80% or less, the strength of the remaining wall thickness may be determined by taking more detailed measurements and using the RSTRENG® or ASME/ANSI B31G method or an alternative equivalent method of calculating the remaining strength to verify that the facility is commensurate with the design pressure of the affected segment. General corrosion may be repaired using one (1) of the methods in Table 2. Refer to Section 6 for additional details and limitations on repair method procedures. Corrosion selectively affecting a longitudinal weld seam should be treated according to Table 2.

Table 2

Repair Methods for External Corrosion on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[1]**
Localized pitting (A non-leaking area on the pipe surface that contains corrosion pits over a non-contiguous area)	Located in the pipe body **and** External corrosion passes remaining strength pressure assessment (e.g., RSTRENG®)	• Clean and recoat[2]
	Located in the pipe body or weld **and** Maximum depth of 80% or less of nominal wall thickness **and** External corrosion fails remaining strength pressure assessment (e.g., RSTRENG®)	• Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or** • Install a Type A or B welded full encirclement split sleeve of the appropriate design **or** • Install a composite sleeve. **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder
	Maximum depth greater than 80% of nominal wall thickness	• Install a Type B welded full encirclement split sleeve of the appropriate design **or** • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder
	Corrosion is less than 10% below the pipe body surface	• Clean and recoat[2]
	Located at a seam or girth weld **and** Corrosion is greater than 10% below the pipe body surface	• Install a Type B welded full encirclement split sleeve of the appropriate design **or** • Install a composite sleeve **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder
General Corrosion (General corrosion is considered corrosion pitting so closely grouped as to affect the	Not located at a seam or girth weld **and** Maximum depth of 80% or less of nominal wall thickness	• Perform an engineering assessment to validate the remaining strength of the pipe **or** • Install a Type A or B welded full encirclement split sleeve of the appropriate design **or** • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or** • Install a composite sleeve. **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder

[1] Refer to Section 6 for additional details and limitations on repair method procedures.

[2] The use of other repair methods listed in Table 2 is also acceptable.

Table 2

Repair Methods for External Corrosion on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[1]**
overall strength of the pipe)	Maximum depth greater than 80% of nominal wall thickness	• Install a Type B welded full encirclement split sleeve of the appropriate design **or** • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder
	Located at a seam or girth weld	• Install a Type B welded full encirclement split sleeve of the appropriate design **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder
Selective Seam Corrosion	Selective seam corrosion in electric fusion welded (EFW) weld does not extend below the pipe body surface	• Grind/Sand to remove the corrosion in the weld metal **and** • Clean and recoat[3].
	Selective seam corrosion in electric resistance welded (ERW) welds or in electric-fusion welded (EFW) welds that extends below the pipe body surface	• Install a Type B welded full encirclement split sleeve of the appropriate design **or** • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder

5.6 Internal Corrosion: Non-Leaking

Internal corrosion must be measured using an ultrasonic thickness gauge. Since the corrosion cannot be visibly inspected, the remaining strength should be assessed using the ASME B31G calculations. If an area of interest passes the remaining strength assessment and is recoated, the feature must be continually monitored as the corrosion is not arrested and may continue to grow.

[1] Refer to Section 6 for additional details and limitations on repair method procedures.

[3] The use of other repair methods listed in Table 2 is also acceptable.

Table 3

Repair Methods for Internal Corrosion on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[4]**
Internal Corrosion	Passes ASME B31G remaining strength pressure assessment	• Clean and recoat pipe following assessment[5] **and** • Continually monitor the area for further internal corrosion
	Fails ASME B31G remaining strength pressure assessment **or** wall loss is greater than 70%	• Install a Type B welded full encirclement split sleeve of the appropriate design **or** • Remove corroded area by cutting out and replacing the pipe as a cylinder

5.7 Dents, Gouges, Cracks, Arc Burns and Hard Spots

For dents, gouges (including grooves, notches, scrapes and scratches), cracks, arc burns and hard spots, an appropriate tool (e.g., ultrasonic thickness gauge, profile gauge, pit gauge) shall be used to verify the nominal wall thickness outside of the defect area for comparison to the measured wall thickness within the defect area to determine the associated metal loss, if any.

The pipe wall shall be evaluated for cracks using magnetic particle or dye penetrant inspection. If cracking is discovered, reduce the pressure by 20% from the operating pressure.

Dents, gouges, cracks, arc burns and hard spots may be repaired using one of the methods in Table 4. Refer to Section 6 for additional details and limitations on repair methods.

[4] Refer to Section 6 for additional details and limitations on repair method procedures.

[5] The use of other repair methods listed in Table 3 is also acceptable.

Table 4

Repair Methods for Dents, Gouges, Cracks, Arc Burns and Hard Spots on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[6]**
Dents in the pipe body[7]	No metal loss **and** Depth less than 6% of specified O.D.	• Clean and recoat[9]
	No metal loss **and** Depth equal to or greater than 6% of specified O.D.	• Install a Type B welded split sleeve of the appropriate design **or** • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or** • Install a composite sleeve[10]) **or** • Remove by cutting out and replacing the pipe as a cylinder
	Includes a stress concentrator or mechanical damage with a depth of less than 10% of nominal wall thickness **and** Depth less than 4% of specified O.D.	Grind/sand to remove stress concentrators and/or sharp edges. No repair is required. Clean and recoat.

	Includes a stress concentrator or mechanical damage with a depth of between 10% and 40% of nominal wall thickness **and** Depth less than 4% of specified O.D.	• If the grind is less than the maximum length restriction in Section 6.7.2, no repair is required. Clean and recoat.
		• If the grind is greater than the maximum length restriction in Section 6.7.2:
		  • Install a Type B welded split sleeve of the appropriate design **or**
		  • Remove by cutting out and replacing the pipe as a cylinder

[6] Refer to Section 6 for additional details and limitations on repair method procedures.

[7] In evaluating plain dents, the need for the segment to be able to safely pass an internal inspection or cleaning device shall also be considered.

[9] The use of other repair methods listed in Table 4 is also acceptable.

[10] If composite sleeve is used contact manufacturer to verify dent size limitations.

Table 4

Repair Methods for Dents, Gouges, Cracks, Arc Burns and Hard Spots on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[6]**
Dents in the pipe body.[8]	Includes a stress concentrator or mechanical damage with a depth of greater than 40% of nominal wall thickness **and** Depth less than 4% of specified O.D.	• Install a Type B welded split sleeve of the appropriate design **or** • Remove by cutting out and replacing the pipe as a cylinder
	Includes a stress concentrator or mechanical damage **and** Depth greater than 4% of specified O.D.	• Install a Type B welded split sleeve of the appropriate design **or** • Remove by cutting out and replacing the pipe as a cylinder
Dents affecting a seam or girth weld	Depth less than 2% of specified O.D.	• An engineering evaluation considering the vintage and metallurgical properties of the weld seam shall be performed **or** • Install a Type B welded split sleeve of the appropriate design **or** • Remove by cutting out and replacing the pipe as a cylinder
	Depth greater than 2% of specified O.D.	• Install a Type B welded split sleeve of the appropriate design **or** • Remove by cutting out and replacing the pipe as a cylinder
Gouges, grooves, notches, scrapes and scratches	Metal loss less than 10% of nominal wall thickness	• Grind/sand to remove stress concentrators and/or sharp edges. If there is still less than 10% metal loss after grinding, no repair is required. Clean and recoat[11].

[6] Refer to Section 6 for additional details and limitations on repair method procedures.

[8] In evaluating plain dents, the need for the segment to be able to safely pass an internal inspection or cleaning device shall also be considered.

[11] The use of other repair methods listed in Table 4 is also acceptable.

Table 4

Repair Methods for Dents, Gouges, Cracks, Arc Burns and Hard Spots on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[6]**

Gouges, grooves, notches, scrapes and scratches	Metal loss between 10% and 40% of measured wall thickness	• Grind/Sand to remove stress concentrators and/or sharp edges, **and**
		  • If less than the maximum length restriction in Section 6.7.2, no repair is required. Clean and recoat[12].
		  • If the maximum length restriction in Section 6.7.2 is exceeded,
		  • Install a Type B welded full encirclement split sleeve of the appropriate design **or**
		  • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or**
		  • Install a composite sleeve **or**
		  • Remove by cutting out and replacing the pipe as a cylinder

	Metal loss of 40% of measured wall thickness or greater	• Grind/Sand to remove stress concentrators and/or sharp edges, **and**
		  • Install a Type B welded full encirclement split sleeve of the appropriate design **or**
		  • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on split sleeve) of the appropriate design **or**
		  • Install a composite sleeve **or**
		  • Remove by cutting out and replacing the pipe as a cylinder

[6] Refer to Section 6 for additional details and limitations on repair method procedures.

[12] The use of other repair methods listed in Table 4 is also acceptable.

Table 4

Repair Methods for Dents, Gouges, Cracks, Arc Burns and Hard Spots on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[6]**
Cracks	Crack with leak	• Install a Type B welded full encirclement split sleeve of the appropriate design, **or** • Install a mechanical reinforcement sleeve (i.e., full encirclement bolt-on sleeve) of the appropriate design. • Remove by cutting out and replacing pipe as a cylinder.
	Depth of crack (non-leaking) is unknown.	• See Section 6.7.1.1
	Depth of crack (non-leaking) is determined using shear wave ultrasonic instrument and is less than 80% of measured wall thickness.	• See Section 6.7.1.2

Arc Burns	Any	• Grind/Sand[13] to remove stress concentrators, sharp edges, and/or hard or soft spots, **and**
		  • If less than the maximum length requirement in Section 6.7.2, recoat[14] **or**
		  • If greater than the maximum length requirement in Section 6.7.2,
		  • Install a Type B welded full encirclement split sleeve of the appropriate design **or**
		  • Remove by cutting out and replacing the pipe as a cylinder

Hard Spots	Less than 35 Rockwell C Hardness.	• Clean and recoat[14].
	Unknown hardness or Rockwell C Hardness greater than 35 **and** No cracks found during magnetic particle inspection	• Install a Type A[15] or B welded full encirclement split sleeve of the appropriate design **or** • Remove by cutting out and replacing the pipe as a cylinder

[6] Refer to Section 6 for additional details and limitations on repair method procedures.

Table 4

Repair Methods for Dents, Gouges, Cracks, Arc Burns and Hard Spots on Steel Pipe		
Type of Defect	**Defect Evaluation**	**Repair Method[6]**
	Unknown hardness or Rockwell C Hardness greater than or equal to 35 **and** Cracks found during magnetic particle inspection	• Install a Type B welded full encirclement split sleeve of the appropriate design **or** • Remove by cutting out and replacing the pipe as a cylinder

5.8 Stress Corrosion Cracking (SCC)

If SCC cracks are found during pipeline examination, they should be documented with photographs and the length, density, spacing and general location shall be recorded. Contact Systems Operations (Columbia) or Gas Measurement &Transmission (NIPSCO) for repair requirements.

6. REPAIR METHODS

Personnel performing repair method procedures that are covered tasks under the Company's Operator Qualification Plan must be qualified to perform the repair procedure or directed and observed by a person qualified to perform the repair procedure. Personnel performing welding, mechanical tapping/stopping, and nondestructive testing must be qualified in accordance with the Company's Operator Qualification Plan for that covered task.

6.1 Welded Full Encirclement Sleeves Type A (Non-Pressure Containing)

A Type A sleeve is a full encirclement device that fits snugly around the pipe and is designed for situations where the existing pipe needs additional strength, but is not intended to contain pressure or repair leaks. The sleeve must be designed to have a strength at least equal to the MAOP of the pipe being repaired and must be at least one pipe diameter in length. Ensure that the sleeve covers the imperfection(s) plus a

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[13] If total removal of the arc burn is deemed necessary, confirm the complete arc burn has been removed by swabbing the area with a 10% solution of ammonium persulfate in water or with an etchant such as 5% nitric acid in pure ethanol (Nital). If a dark spot appears, continue filing or sanding, followed by re-swabbing, until the black spot is completely removed.

[14] The use of other repair methods listed in Table 4 is also acceptable.

[15] Use of a Type A sleeve or a composite sleeve or wrap requires grinding to remove all stress concentrators and damaged material. Complete removal of stress concentrating features shall be verified by performing wet magnetic particle or dye penetrant inspection of the exposed pipe.

minimum of six (6) inches past the defect on each end when practical, if impractical a minimum of two (2) inches is required.

An ultrasonic or other non-destructive test is recommended before welding to check the integrity of the pipe surface where the sleeve is to be installed. Consideration should be given to reducing the operating pressure of the pipeline during installation of the sleeve to improve the fit.

If a dent, corrosion pit or mechanical damage is repaired with a Type A sleeve, the dent, pit or mechanical damage shall first be filled with an incompressible filler.

Weld the long seams of the sleeves ensuring that deposited weld metal does not come in contact with the pipeline. A backup strip may be used for this purpose. Do not weld the ends of the sleeve to the pipeline. Non-destructive testing of the welds is not required.

Seal the ends of the steel sleeve with an approved filler material creating a smooth transition from the sleeve to the surface of the pipe and recoat.

6.2 Welded Full Encirclement Sleeves Type B (Pressure Containing)

A Type B sleeve is a full encirclement sleeve designed to be welded to the pipeline and contain the full operating pressure. This sleeve can be used to repair leaks and strengthen the pipe if there are defects present. Type B sleeves are basically the same as Type A sleeves with the ends welded to the pipe. The sleeve must be designed to have a strength at least equal to the design pressure of the pipe being repaired.

An ultrasonic or other non-destructive test is recommended before welding to check the integrity of the pipe surface where the sleeve is to be installed. Consideration should be given to reducing the operating pressure of the pipeline during installation of the sleeve to improve the fit.

If a Type B sleeve is used to repair corrosion or a defect within a longitudinal pipe seam or to repair a longitudinal crack, the defect length must be determined to be subcritical by an Engineer trained to perform such an analysis, or the sleeve must be pressurized to inhibit defect growth. An incompressible filler shall be used to fill in voids between the pipe and sleeve when repairing dents, pits and/or mechanical damage.

Use a sleeve that is at least one pipe diameter in length. Ensure that the sleeve covers the imperfection(s) plus a minimum of six (6) inches past the defect on each end when practical, if impractical a minimum of two (2) inches is required.

6.3 Mechanical Reinforcement Sleeves

Full encirclement mechanical sleeves are available that are used for the same

applications as Type A or B sleeves, whereby the sleeves are installed by bolting them on to the pipe. The sleeve ends and longitudinal joints may be welded if desirable. For pipelines operating above 40% SMYS, the sleeve must be welded if the sleeve is to be considered a permanent repair. This type of sleeve must meet or exceed the pressure rating of the pipeline.

6.4 Other Sleeves

Special configurations of the Type B sleeve are available for applications where there are raised features within the defect area to be reinforced. These types of sleeves are designed to encapsulate or reinforce couplings, wrinkle bends, buckles, temporary repair clamps, ovality problems, or girth welds. These sleeves are sometimes referred to as a “pumpkin” or “balloon” Type B sleeve.

The wall and grade of the sleeve material must be designed so that the pressure rating is the same or greater than that of the pipeline.

6.5 Bolted Clamps

Bolted clamps can be used to permanently repair isolated external corrosion pitting, provided all of the following are met:

a. The pipeline operates below 40% SMYS,

b. The clamp is rated by the manufacturer to a pressure which equals or exceeds the MAOP of the pipe, and

c. The length of the clamp is sufficient to extend beyond the ends of the defect so that the leak seals can be properly seated.

Bolted clamps may also be used to temporarily repair pipeline leaks that are not due to isolated corrosion pitting. Replace mechanical leak clamps with a permanent repair as soon as feasible.

6.6 Composite Materials

Approved composite repair methods may be used as a means of permanent repair for the following non-leaking defects.

a. Defects due to corrosion, provided at least 20% of the nominal wall thickness remains.

b. Corrosion defects on girth welds (meeting the criteria of the manufacturer of the composite material).

NOTE: Clock Spring and Snap Wrap require that at least 50% of the nominal wall thickness remains and the defect is limited to a total of 30% circumference of the pipe for single or multiple corrosion cell(s) on the girth weld.

c. Dents (meeting the criteria of the manufacturer of the composite material, using the appropriate filler material).

d. Gouges, provided stress concentrators have been removed by grinding in accordance with the criteria specified by the manufacturer of the composite material).

Do not use composite sleeves or wraps to repair leaks, cracks, weld imperfections, or metal loss due to internal corrosion.

Composite sleeves and wraps shall be installed according to manufacturer instructions and by a certified person (i.e., a person that has been trained according to manufacturer's requirements).

After the composite repair is completed, install two metallic band clamps (i.e., locate bands) at the ends of the composite sleeve or wrap, but not overtop of the anomaly, so the location is recognizable to a smart pig as a repair.

6.7 Grinding

Grinding is the removal of a defect by using abrasive tools and materials, such as sanding discs or grinding wheels. Grinding may be used to repair non-leaking defects if the damaged area will be completely eliminated, if the remaining wall thickness is sufficient for the MAOP, and if no sharp or abrupt changes in contour remain within the ground area (i.e., grinding shall produce a smooth contour in the pipe wall).

If a reinforcing sleeve is necessary, the transition from the area where the imperfection was removed to the surrounding undisturbed material shall be smooth.

6.7.1 Grinding to Remove Cracks

When grinding is used to remove a crack the following procedure shall apply.

6.7.1.1. When Depth of Crack is Unknown

a. Grind up to 5% of the measured wall thickness of the pipe.

b. Check for crack using the magnetic particle or dye penetrant process.

c. If a crack is present grind additional 5% and recheck for crack. If grinding exceeds 10% of the wall thickness the length of the grinding area is limited. See Section 6.7.3.

d. Continue as in "a" and "b" above until grinding (within the allowable grinding length) reaches no more than 20% of measured wall thickness.

e. If crack is removed clean and recoat. If crack is present repair according to Section 6.7.1.2. If depth of crack is not able to be measured repair according to Section 6.7.1.2.c.

6.7.1.2. When Depth of Crack is known

a. Use a shear wave ultrasonic instrument to measure depth of the crack. (Operator must be qualified in proper operation and data interpretation for shear wave ultrasonic instrument.)

b. If crack depth is 40% or less than the measured wall thickness and within maximum allowed grinding length per Section 6.7.3, repair as follows.

   i. Grind/Sand to remove the crack, including stress concentrators and/or sharp edges. Clean and recoat.

c. If crack depth is greater than 40% of the measured wall thickness repair as follows.

   i. Install a Type B welded pressurized full encirclement split sleeve of the appropriate design, **or**

   ii. Install a pressurized mechanical sleeve of the appropriate design, **or**

   iii. Remove by cutting out and replacing the pipe as a cylinder.

6.7.2 Written Plan

A written plan is required for in-service grinding repairs, with the following exception.

a. when grinding repairs are made with sanding discs, and

b. when grinding repairs do not reduce the wall thickness by more than 10% of the nominal wall thickness.

NOTE: The nominal wall thickness should be determined by researching pipeline installation records, using ultrasonic testing, and/or referring to GS 2110.020 “Steel Pipe Design” Exhibit A.

Pipeline Safety and Compliance or a member of the local Pipeline Integrity Management Team shall approve a required written grinding plan before the repair is made. The plan should include the defect characteristics (e.g., defect type, depth, length, metal loss), reduction of operating pressure, approximate grinding depth in steps, wall thickness measurements, inspections for cracks

and hard or soft spots, minimum wall thickness allowed for an allowable grinding repair, further pressure reduction (if necessary), and a contingency plan if allowable grinding does not completely remove the defect. See Exhibit A for a sample grinding plan.

6.7.3 Limitations

Grinding is permitted to a depth of 10% of the nominal pipe wall with no limit on length of the grind area. Grinding is permitted to a depth greater than 10%, but less than 40% of the nominal pipe wall, with metal removal confined to a length given by the following equation.

$$L = 1.12\left[(Dt)\left(\left(\frac{a/t}{1.1a/t - 0.11}\right)^2 - 1\right)\right]^{1/2}$$

Where, a = measured maximum depth of ground area (in.),

D = nominal outside diameter of the pipe (in.) (e.g., 8.625", 16"),

L = maximum allowable longitudinal extent of the ground area (in.),

t = nominal wall thickness of pipe (in.) (e.g., 0.188", 0.250").

If grinding exceeds the limits discussed above, the grind area may be evaluated as follows.

If the minimum remaining wall thickness measured in the grind area exceeds the required nominal wall thickness for the pipeline, as calculated using the pipeline design calculation in Code of Federal Regulations Part 192.105, no additional repair is required. GS 2110.020 "Steel Pipe Design" should be consulted to perform the design calculations. The minimum remaining wall thickness should be included on all field inspection documentation.

6.7.4 Inspections

The remaining wall thickness shall be verified using ultrasonic testing (GS 1430.320 "Ultrasonic Thickness Gauge") or another appropriate tool. If the remaining wall thickness is insufficient for the MAOP, the damage shall be repaired or removed according to the guidance in Table 4 above for "Gouges, scratches and grooves with metal loss of 40% of nominal wall thickness or greater," so that serviceability is restored.

After grinding to a smooth contoured surface, the surface shall be inspected using a nondestructive surface examination method capable of detecting cracks (e.g., magnetic particle, dye penetrant) to ensure complete removal of

the defect. Furthermore, if the defect is an arc burn, the surface shall be inspected for hard and soft spots with a suitable etchant (e.g., Ammonium Persulfate used in 10% by weight solution, Nital used in a 5% by weight solution) to ensure complete removal of the defect. If the defect has not been completely removed, grinding may be resumed up to the maximum depth allowed for the length of the defect. Continue inspecting and grinding until no defects remain or the maximum depth allowed for the length of the defect is reached.

If grinding within the depth and length limitations fails to completely remove the defect, the defect shall be repaired or removed according to the guidance in Table 4 above for “Gouges, scratches and grooves with metal loss of 40% of nominal wall thickness or greater,” so that serviceability is restored.

7. TESTING OF REPAIRS

The following tests are required after a repair is made to a transmission line.

a. Repairs made by installing a welded reinforcing sleeve shall have the fillet welds tested in accordance with Company welding procedures.

b. For repairs made by cutting out the defect as a cylinder, the replacement pipe used shall be pre-tested pipe or tested before being installed.

c. Repair welds shall be visually inspected by a qualified person to ensure the welding was performed in accordance with the welding procedure.

d. Welds on pipe to be operated at a pressure that produces a hoop stress of 20% or more of SMYS must be non-destructively tested in accordance with company procedures, except that welds that are visually inspected and approved by a qualified person need not be nondestructively tested if the pipe has a nominal diameter of less than six (6) inches.

e. Welds found to be defective shall be repaired or removed in accordance with Company procedures.

8. METALLIC PIPELINE EXPOSURE EXAMINATION REQUIREMENTS

Refer to GS 1410.010 "Metallic Pipeline Exposures" to perform the inspections required for metallic pipeline exposures. Also, refer to IMP 6-17 “Transmission Pipeline Exposures” and IMP 6-18 “Defect Classification and Response Schedule” or for NIPSCO, IMP 05-001 “Addressing Conditions Found during an Integrity Assessment” which stipulates additional data collection and testing requirements, as well as mandating the completion of two (2) forms: a dig sheet and a defect repair form.

9. RECORDS

The following information on each repair made to the transmission line shall be documented:

a. date,

b. location, and

c. description of each repair made.

Repairs, replacements or abandonments of transmission lines shall be documented in the Company work management system, or equivalent.

In addition all repairs on transmission lines shall be reported in accordance with IMP 6-18 “Defect Classification and Response Schedule,” Section 2 “Data Collection and Recordkeeping” or for NIPSCO, IMP 05-001, “Addressing Conditions Found during an Integrity Assessment.”

Results and input data from RSTRENG® or ASME B31G (or an alternative equivalent method of calculating the remaining strength) used to support the MAOP of the pipe that remains in service must be retained in the Pipeline Integrity files and/or the Engineering files, as appropriate.

Repair records for pipe in a transmission line shall be retained for as long as the pipe remains in-service, but not less than five (5) years from the date of the repair.

Repair records for parts of a transmission pipeline other than pipe shall be retained for the longer of five (5) years, or if the repair was generated by a required patrol, survey, inspection or test, then the records shall be maintained until the next required patrol, survey, inspection or test.

MiSource
Distribution Operations

Gas Standard

Effective Date: 06/01/2016	**Transmission Line Field Repair**	Standard Number: **GS 1730.010**
Supersedes: 07/01/2014		Page 23 of 24

EXHIBIT A

(Sample) Grinding Plan
for Gouge on 30-inch Transmission Line located at
123 State Route 1, Anytown, Anystate

Pipeline Characteristics:
The subject dig site contains a gouge on a 30-inch transmission line with the following properties:

- nominal outside diameter of pipe = 30.000”
- nominal wall thickness of pipe = 0.375”
- pipe grade = X-42
- MAOP = 500 psig
- Class 2 location
- Operating pressure at time of defect was discovered = 385 psig
- Operating pressure was lowered to 300 psig (78% of 385 psig)

Defect Characteristics:

The gouge has a measured depth of 0.080 inches deep, which is equal to 21.3% metal loss. The gouge is 1.1” wide by 2.1” long.

Grinding Limitations:
Maximum length of grind area:

$$L = 1.12\left[(Dt)\left(\left(\frac{a/t}{1.1a/t - 0.11}\right)^2 - 1\right)\right]^{1/2}$$

a = measured maximum depth of ground area (in.) = 0.090 (round up from defect depth measurement to assure total defect removal)
D = nominal outside diameter of the pipe (in.) = 30.000
t = nominal wall thickness of pipe (in.) = 0.375
L = maximum allowable longitudinal extent of the ground area (in.), which has been calculated to be = 4.49”; therefore, grinding is acceptable.

Estimated Remaining Strength Calculation (must be confirmed with final actual measurements):
Based on estimated final grind repair dimensions of 4” length, 1.5” width, and 0.090” depth, the remaining strength is calculated to be commensurate with the MAOP.

Grinding Plan:

1. Grind or sand the gouge to a maximum depth of 0.090 inches and a maximum length of 4.4 inches.
2. The sides or shoulders of the ground-out area shall be smooth and uniformly contoured from the outside surface of the pipe wall to the depth of the ground area. No sharp or abrupt changes in contour shall be allowed to remain within the ground area.
3. If defect is still noted, continue grinding if grinding limitations will not be exceeded.
4. If defect is no longer visible, inspect the defect area using a magnetic particle inspection to ensure complete removal of the defect.
5. If the inspection indicates the defect still exists, continue grinding if grinding limitations will not be exceeded. Re-inspect for defect with magnetic particle inspection.
6. Once the complete defect removal is confirmed by the magnetic particle inspection, note final dimensions of the defect using a profile gauge so that a remaining strength calculation can be performed and verified to be commensurate with the MAOP.

Contingency Plan:

If the defect cannot be completely removed within the acceptable grinding limitations, install a Type B welded full encirclement split sleeve rated for a minimum of 500 psig.

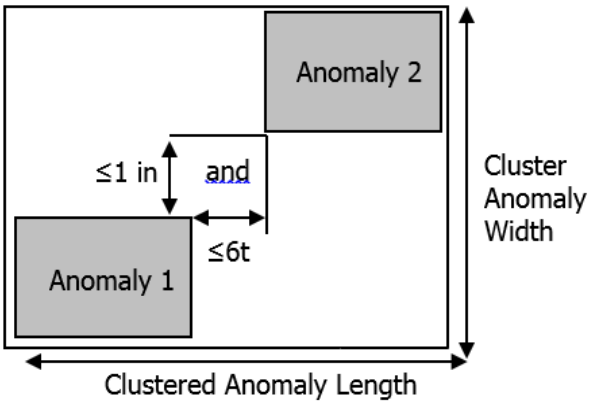
EXHIBIT B

Interaction Rules for Metal Loss Anomalies

The interaction rules illustrated below applies to external non-leaking corrosion. Refer to Section 5.3.

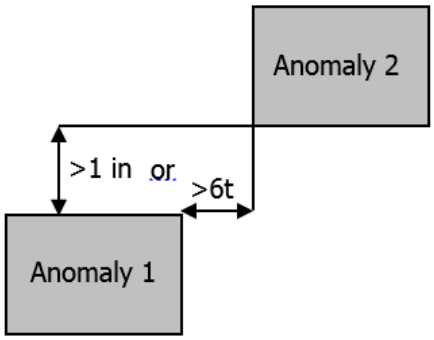
Example of Anomalies that Interact

Individual reported anomalies interact if they are less than or equal to 6t apart in the longitudinal direction **AND** less than 1 inch apart in the circumferential direction.



Example of Anomalies that DO NOT Interact

Individual reported anomalies do not interact if they are more than 6t apart in the longitudinal direction **OR** more than 1 inch apart in the circumferential direction.



MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Abandonment of Facilities**	Standard Number: **GS 1740.010**
Supersedes: 01/01/2013		Page 1 of 6

Companies Affected:

☑ NIPSCO	☐ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☐ CPA

REFERENCE 49 CFR Part 192.727

1. GENERAL

This standard shall apply to the abandonment or deactivation of pipeline facilities.

An inactive pipeline not being maintained by the Company shall be abandoned.

2. DISTRIBUTION MAINS AND TRANSMISSION LINES

When it has been determined that a distribution main or transmission line (pipeline) has no reasonable prospect for future use, it shall be scheduled for retirement.

Each pipeline abandoned in place must be disconnected from all sources of gas supply, purged of all gas, and the ends sealed.

2.1 Written Plan

Field Engineering shall prepare a written plan to accomplish the work, ensuring proper supply is maintained to the parts of the system to remain in service, and gas to the pipeline to be abandoned is properly stopped by disconnecting all sources. If the plan requires modification prior to being executed, it shall be reviewed and approved by the preparer.

The written plan shall identify the method for stopping the gas flow from the sources. Typical methods include the use of valves, squeezers, stoppers, or bag(s). Alternate methods for each source should be identified in case the planned method cannot accomplish stopping the gas, such as inoperable valves or conflicts with other underground facilities.

The following actions should be considered when developing the written plan.

a. Installing gauge(s) to monitor upstream pressure before stopping the gas.
b. Installing fittings for pressure verification and gas venting.
c. Stopping gas from all sources.
d. Venting to allow pressure to decrease in pipe being abandoned.
e. Checking that the flow from the vent continues to decrease – all sources addressed.

f. Physically separating the section to abandon.

g. Capping live stubs by appropriate methods. Preferred methods are welding for steel, fusion for plastic, and mechanical connection for other materials. All mechanically connected caps shall have pull-out protection (integral to the fitting, or by strapping / blocking), and be properly pressure rated.

2.2 Disconnect Gas Sources

Identify all likely sources of supply to the pipeline to be abandoned. A check of operating records (e.g., maps, work completion) should first be done. Any other suspected sources can be identified by field excavation.

Upon stopping of gas flow at each point of disconnection, physically separate the piping or components.

2.3 Purging Pipelines

Refer to GS 1690.010 “Purging” for guidance on purging pipelines out of service.

2.4 Seal Pipeline Ends

Seal all ends of the abandoned piping with an approved end cap, a closed valve, or other approved methods to prevent a path of gas migration, such as the following.

1. Expanding foam (e.g., FOA-0010)
    a. Clean out any loose particles or debris from the end of the main to be abandoned.
    b. Insert cardboard, newspaper, or rags into the main to serve as a backstop for the foam.
    c. Allow room for approximately 1 1/2" of foam for each 1" of main diameter. For example, on a 4" main use 4” - 6" of foam; on a 6" main, use 6” - 9" of foam, etc.
    d. Cut out a piece of cardboard slightly larger than the diameter of the main to be abandoned. This piece should be held against the end of the main to contain the foam as it expands in the pipe.
    e. The foam should be sprayed directly into the main or sprayed through a hole cut in the cardboard. Field conditions should dictate the best method of application.
2. Expansion plug (e.g., PLU-0010)
    a. Clean out any loose particles or debris from the end of the main to be abandoned.
    b. Squarely fit plug into end of main and hand press in firmly.

c. Check by pulling outward on plug.

3. Plastic cap (e.g., CAP-0020)
4. Concrete

2.5 Above Ground and Grade Level Facilities

All above ground and grade level pipeline facilities retired from service shall be removed. Examples of above ground and grade level pipeline facilities include pipe, valves, valve boxes, M&R stations, pipeline markers (i.e., posts, signs), corrosion control test station boxes.

Valve boxes and grade level corrosion test stations boxes (if they exist) shall be removed and the hole filled with a suitable compacting material. If the boxes cannot be removed due to their location in concrete or pavement, the box lids shall be removed and the boxes filled with concrete or similar material.

EXCEPTION: Piping above ground on private property that is not covered by a removal clause in the right-of-way agreement may be allowed to remain unless requested to be removed by the right-of-way grantor.

The steps in Section 2 must be followed through the purging process before the removal of any facilities. Removal will create additional points to be capped as per Section 2. This must be allowed for in the written plan.

3. SERVICES

3.1 Conditions Requiring Abandonment

3.1.1 Meters

Service lines that have gas service discontinued, i.e. where the gas has been turned off, may have the meter remain in place for up to 24 months, at which time an order to remove the meter should be issued. The meter may continue to remain in place if circumstances indicate it is appropriate.

NOTE: When the last meter is removed from a service line, any curb valve in the line shall be closed if it can be located and it is operable.

3.1.2 Service Lines

Service lines that have gas discontinued should be evaluated for the prospect of future use by the end of the 24th month from the day the gas service was discontinued. If no prospect for future can be determined, then the service line shall be abandoned.

Service lines that have not had a meter installed (e.g., NSL classification for CDC) should be evaluated for the prospect of future use by the end of the 24th month from the date the service line was placed in service. The service line shall be abandoned if it is determined that the service line has no prospect for future use or before the Company's state regulatory required maximum length of time to abandon it, whichever occurs first.

Service lines shall be abandoned not later than the end of the 60th month from either the date that the gas service was discontinued, or when the service line was placed in service for a service line that has not had a meter installed.

3.2 Abandoning Service Lines

When abandoning service lines, the piping must be disconnected from the gas supply and customers' house lines, and the abandoned pipe end(s) sealed. This should be accomplished similar to the procedure in Section 2, with the following exceptions.

a. A written plan is not needed.

b. Verification and venting can be accomplished by aboveground piping at a meter setting.

c. Natural venting is normally sufficient to purge a service line that is being abandoned. However, a service line being abandoned shall be purged with a purging medium if natural venting is not effective.

d. The service line should be disconnected as close as practical to the supplying pipeline.

e. Where a service line enters below grade through a basement wall, the end of the service line should be plugged and capped as close to the face of the wall as practical. It is not necessary to remove pipe from the wall unless required by particular circumstances.

f. Aboveground piping and fittings, such as a measurement setting, should be removed unless attached to a structure.

Where positive-stop tapping tees exist, it is preferred to stop the gas flow with the positive-stop tapping tees and cap the outlet of the tees. If the "punch" or "cutter" of positive-stop tapping tees is used to affect the disconnection at the main, the "punch" or "cutter" shall be retracted until even with the top of the tees before replacing the tee caps.

Where the tapping tees do not have a positive stop, the outlet piping of plastic tees can be squeezed and some steel tees can have the gas stopped in the tee body, such as by pinning with a metal rod or wooden dowel. The connected piping can then be cut and the outlet of the tee capped.

Other methods to abandon service lines, such as plugging saddles or installing clamps

on the main, can be used.

If service lines are abandoned in conjunction with the abandonment of the supply pipeline, the service lines do not need to be disconnected from the pipeline and no venting of the service line is required if the volume of gas in the line is not considered potentially hazardous.

When service lines are abandoned, curb boxes (if they exist) shall be removed and the hole filled with a suitable compacting material. If the curb boxes cannot be removed due to their location in concrete or pavement, the curb box lids shall be removed and the curb boxes filled with concrete or similar material.

4. VAULTS

Each abandoned vault must be filled with a suitable compacting-type material. While filling the vault, ensure that the material flows into all areas so that no voids remain. If necessary, the material can be tamped while filling to achieve some initial compaction.

As an alternate to abandoning a vault, it could be removed and the space previously occupied filled as a typical excavation. All proper safety precautions must be followed considering the depth and all other factors of the work.

5. ABANDONMENT OF PIPELINE FACILITIES INVOLVING COMMERCIALLY NAVIGABLE WATERWAYS

If the pipeline facility abandoned is an onshore pipeline that crosses over, under, or through a commercially navigable waterway, a report must be prepared and submitted by either of the following methods.

5.1 Submit Report to the National Pipeline Mapping System (NPMS)

The preferred method to submit data on pipeline facilities abandoned is to the National Pipeline Mapping System (NPMS) in accordance with the NPMS "Standards for Pipeline and Liquefied Natural Gas Operator. A digital data format is preferred, but hard copy submissions are acceptable if they comply with the NPMS Standards.

In addition to the NPMS-required attributes, the Company must submit the date of abandonment, diameter, method of abandonment, and certification that, to the best of the Company's knowledge, all of the reasonably available information requested was provided and, to the best of the Company's knowledge, the abandonment was completed in accordance with applicable laws.

Refer to the NPMS Standards for details in preparing data for submission.

5.2 Submit Report to the PHMSA Information Officer

Alternatively, the Company may submit reports by mail, fax or e-mail to the Information

Officer, Office of Pipeline Safety, Pipeline and Hazardous Materials Safety Administration, Department of Transportation, Information Resources Manager, PHP-10, 1200 New Jersey Avenue, SE., Washington, DC 20590-0001; fax (202) 366-4566; e-mail InformationResourcesManager@phmsa.dot.gov.

The information in the report must contain all reasonably available information related to the facility, including information in the possession of a third party. The report must contain the location, size, date, method of abandonment, and a certification that the facility has been abandoned in accordance with all applicable laws.

6. RECORDS

Abandoned facilities shall be included on the applicable work completion report for the retirement.

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MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2011	**Abandoning Facilities Service Tee Removal**	Standard Number: **GS 1740.012**
Supersedes: 06/10/2011		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☐ CPA

1. GENERAL

This Gas Standard applies to situations in which a service tee is to be removed from a main but has no means of stopping the gas flow. This Gas Standard provides an alternative method to those provided in GS 1714.020 "Leakage: Distribution Pipe Repair," and does not apply in situations where the service tee can remain on the main. All applicable Company safety standards shall be followed.

2. "PINNING" PROCEDURE

1. Insert a tapered steel pin through the tee into the main.
2. Hammer the pin into the main using a brass hammer or other safe means.
3. Purge gas out of the service line and remove the service line from the service tee or as close to the main as possible.
4. While securing the pin by hand, cut the tee off as close to the main as possible using a hack saw.
5. While securing the pin by hand, remove the tee from the main.
6. Weld a bead around the pin and the main line using 6010 or 7010 electrodes.
7. Cut the pin off as close to the main as possible using a hack saw.
8. Complete welding the pin to the main.
9. Fit a 1inch or 2 inch thread-o-let or a Mueller No-Blo save-a-Valve completion plug and cap over the pin.
10. Weld the thread-o-let to the main using 7018 electrodes.
11. Install a steel threaded plug into the thread-o-let.
12. Seal weld the threads with 7018 electrodes.
13. Soap test the plug and thread-o-let to check for leakage.

14. Coat the area with an approved coating and install an anode where required.

Service line removal has been completed.

3. RECORDS

3.1 Records Retention

Abandoned facilities shall be included on the applicable work completion report for the retirement.

NiSource
Distribution Operations

Gas Standard

Effective Date: 03/31/2015	**Discontinuing Gas Service**	Standard Number: **GS 1742.010**
Supersedes: 01/01/2014		Page 1 of 3

Companies Affected:

☑ NIPSCO Effective: 01/01/2015	☐ CGV ☑ CKY ☑ CMA	☑ CMD ☑ COH ☑ CPA

REFERENCE 49 CFR Part 192.727(d)

1. GENERAL

Service to a customer may be discontinued at the customer's request (e.g., moving) or at the Company's discretion (e.g., non-payment).

Discontinuing gas service is an action that the Company takes which results in stopping the flow of gas to the customer. However, discontinuing gas service does not include temporary actions that the Company may take to stop the flow of gas to the customer, such as service line or house line leakage or an outage situation.

Before taking the necessary step(s) to discontinue gas service, the order shall be reviewed to verify:

1. the customer's name and address, and
2. the meter serial number (or meter number tag in CMA, also referred to as the meter badge) and current meter reading, if possible.

2. DISCONTINUING GAS SERVICE

Whenever service to a customer is discontinued, one of the following must be complied with:

a. the valve that is closed to prevent the flow of gas to the customer must be provided with a locking device or other means designed to prevent the opening of the valve by persons other than those authorized by the Company,

b. a mechanical device or fitting that will prevent the flow of gas must be installed in the service line or in the meter assembly, or

c. the customer's piping, i.e. piping downstream of the meter and owned by the customer, must be physically disconnected from the gas supply and the open pipe ends sealed.

Whenever service to a customer has been discontinued, see GS 1740.010, GS 1740.010(MA), GS 1740.010(PA), or GS 1740.010(VA) "Abandonment of Facilities" for service line abandonment requirements.

The following are acceptable methods to discontinue gas service.

2.1 Turn Gas Off At Meter Valve Only

The inlet meter valve (e.g., riser valve) must be locked in the closed position, and wherever the piping configuration allows, a metal disc (i.e., meter seal) or solid swivel shall be installed.

2.2 Turn Gas Off At Curb and Meter Valves

Be sure the correct curb box is identified before shutting off the valve. If there is doubt that the correct curb valve has been turned off, it may be necessary to bleed gas off at the meter or burn gas off at an appliance.

The inlet meter valve (e.g., riser valve) must be locked in the closed position, and wherever the piping configuration allows, a metal disc (i.e., meter seal) or solid swivel shall be installed.

2.3 Turn Gas Off At Curb Valve Only

When access cannot be gained to the meter and the steps in Sections 2.1 or 2.2 cannot be performed, the curb valve shall be shut off and locked to prevent the opening of the valve by unauthorized persons. The following are acceptable locking methods:

a. installing a curb valve locking device,

b. installing a curb box locking, blocking, or plugging device, or

c. locking an existing curb box with a locking lid.

2.4 Remove Meter

When the meter is removed the following shall be done.

a. The gas shall be turned off at the inlet meter valve and the meter valve locked.

b. Once the meter is removed, each open end of the meter set assembly shall be plugged or capped to seal the outlet piping from the meter valve and the inlet to the customer piping.

c. If a curb valve exists, it shall be turned off if the last meter has been removed. Be sure the correct curb box is identified before shutting off the valve. If there is doubt that the correct curb valve has been turned off, it may be necessary to bleed gas off at the meter or burn gas off at an appliance.

2.5 Physical Disconnection of Service Line

When the meter valve is inaccessible and/or if a curb valve is nonexistent or inaccessible, the service line shall be physically disconnected at the main or at the property line. At the point of disconnection, the service line shall be capped, as appropriate, in both directions. The installation of a curb valve should be considered for future use, in lieu of a physical disconnection.

3. RECORDS

The date that gas service was discontinued shall be recorded on the order.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Pressure Regulating Station Operation and Maintenance**	Standard Number: **GS 1750.010(KY)**
Supersedes: 8/01/2015		Page 1 of 6

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
	☑ CKY	☐ COH
	☐ CMA	☐ CPA

REFERENCE: 49 CFR PART §§192.201, .631, .709, .739; KY 807 KAR 5:006 Section 26(3)

1. GENERAL

This gas standard applies to operation and maintenance of transmission and distribution **pressure regulating stations**.

2. PRESSURE LIMITS

2.1 Control Regulator

In no case shall the outlet set pressure exceed the established **maximum allowable operating pressure** (MAOP) of the downstream pipeline.

Low-pressure (LP) systems shall operate within a pressure range that will assure the safe and continuing operation of any connected and properly adjusted low-pressure equipment. The preferred minimum pressure is 7" w.c. and the preferred maximum pressure is 12" w.c. LP systems can be operated outside of the preferred range when warranted, especially during peak flow periods or for other operational needs. Any LP system that must operate at 14” w.c. or greater during peak periods to meet minimum pressure requirements shall be reported to Engineering. Engineering shall evaluate the system for actions (e.g., orifice changes, system improvements) that would be necessary to permit operating the system at or below 14" w.c. at design (peak-day) conditions.

NOTE: Prior to operating a low-pressure system greater than 14” w.c., an analysis shall be completed to determine the customers that would be affected by pressures greater than 14” w.c. Natural gas equipment and/or appliance regulator ratings shall be verified, temporary regulation shall be installed, or inlet pressure to customers’ meter settings shall be monitored for those customers that would be affected by pressures greater than 14”w.c.

2.2 Monitoring Regulator and/or Overpressure Protection Devices

The monitoring regulator and overpressure protection devices (e.g., primary relief valves) must be set to ensure that the outlet of the pressure regulating station does not

go above the pressure limits in Table 1.

Table 1

MAOP	Allowable Build Up
Less than 12 psig	MAOP + 50%
12 psig to 60 psig	MAOP + 6 psig
Over 60 psig	MAOP + 10%, or 75% of SMYS, whichever is lower

For LP systems, monitor regulators and applicable overpressure protection devices (e.g., primary relief valves) should be set high enough to avoid operational issues with the control regulator but low enough as to assure the safe and continuing operation of any connected and properly adjusted low-pressure equipment downstream.

Relief valves which serve as warning devices shall be tagged with a warning device tag. (See Exhibit A)

3. FREQUENCY OF INSPECTION

All pressure regulating stations shall be inspected once each calendar year at intervals not to exceed 15 months, according to the requirements of Section 4.

4. INSPECTION

All pressure regulating stations shall be inspected to determine that they are:

a. in good mechanical condition,

b. set to control or relieve at the correct pressures consistent with the pressure limits in accordance with Section 2.2, and

c. properly installed and protected from dirt, liquid, or other conditions that might prevent proper operation.

The purpose of the inspection is to determine conditions that may adversely affect the proper operation of the pressure regulating station, and to make corrections by cleaning, replacement, or adjustment of parts, when necessary.

4.1 By-passing Requirements

If the station design requires bypassing (i.e., single regulator run) a second qualified

employee shall be present to monitor the bypass operation during the inspection.

Properly calibrated spring gauges shall be used during all bypassing operations to monitor the pressures. Gauges shall not be liquid filled.

See GS 1754.010 “Operation and Maintenance of Pressure Gauges” for minimum calibration intervals.

4.2 Annual Regulator Station Inspection

Gas transmission and distribution pressure regulating stations shall be inspected in accordance with the following. Before beginning the inspection the station inventory record card shall be reviewed to verify the information is accurate and matches the facilities at the site. Any discrepancies found in the information shall be addressed and/or reported to supervision.

If a hazardous atmosphere is **suspected** before entering any building then HSE 4100.010 “Hazardous Atmosphere Consideration” shall be followed.

HSE 4100.010 **may** be used when entering and working in any building. If a hazardous atmosphere is found, then HSE 4100.010 shall be followed.

a. If the pressure in a pressure regulating station is monitored by a SCADA system, Systems Operations must notify Gas Control **before** and after inspections are performed.

b. Check inlet and outlet pressure with an accurate gauge.

   NOTE 1: If inlet or outlet pressure is found to be above the MAOP, notify the local Systems Operations leadership. Investigate and correct the situation as directed by GS 1150.080 “Response to Over Pressure.”

   NOTE 2: If the inlet or outlet pressure is found to be lower than the **normal operating pressure** (refer to GS 1012.010 “Definitions”) typically seen at the pressure regulating station, notify the local Systems Operations leadership.

c. Blow off pilot filters to ensure they are clear of liquids or dirt. In areas known to have debris in the gas or if blowing off the filter yields contaminants, replace the filter media if necessary.

d. Check all pilot and main regulator diaphragms for leakage through the vent. Replace defective diaphragms, if necessary.

e. Vents and vent lines are to be inspected to see that they are secure, clear, have proper vent caps, and that no leaks are present.

f. Inspect external regulator body condition. Inspect all control, sensing, and supply lines making certain that they are mechanically sound, secure, and reasonably protected. All regulators shall be tested to ensure they are in good working order, control at proper set pressure, and operate properly.

g. Pressure controllers shall be inspected with the associated regulator(s) for response and defects.

h. All regulators shall be tested for lock-up. If a regulator will not achieve lock-up a tear down inspection shall be conducted if applicable (Soft Seats). If the regulator still fails to lock up or is a hard seat regulator it shall be reported immediately to supervision to discuss actions taken, remediation (if necessary) and a time frame for remediation.

i. All automatic shut-off valves shall be tested to ensure that they are in good mechanical working order, control at proper set pressure, operate properly, and shut off within the expected and accepted limits.

j. Station filter differential shall be checked with an accurate gauge. The filter shall be blown clear as needed. Heavy concentrations of sediment, dust or liquids, or a high differential shall be reported to the supervisor. Filter elements shall be replaced as necessary.

k. Inspect all overpressure protection devices for response and defects. See GS 1750.040 “Relief Devices Inspection and Maintenance” for additional requirements.

l. Check regulator station for leaks.

m. Inspect any associated fences, buildings, vaults, pits, facility identification signs, warning signs, etc.

n. Inspect entire station for signs of atmospheric corrosion.

o. Heaters are considered part of the station and are to be inspected in accordance with GS 1750.210 “Inspection and Maintenance of Heaters.” Heaters may be set up to be inspected on a different schedule than the station equipment.

p. At the conclusion of the inspection, any additional discrepancies found between the facilities at the site and the record card or any changes that were made to the equipment shall be recorded on the record card. Changes shall also be updated in the work management system.

q. Monitor regulators shall be tagged with their function. Refer to Exhibit A “Available Tags” for ordering information.

4.3 Tear Down Inspection

Tear down inspections are to be done on an as needed basis either as a result of findings during the annual inspection or predetermined based on special circumstances i.e. dirty gas. All functions outlined below shall be performed during the tear down inspection.

a. Complete all steps required for an annual regulator station inspection.

b. Regulator valve assemblies, molded seats, diaphragms, and orifices shall be visually inspected for good mechanical conditions. Repair or replace all worn and defective parts. A fiber optic borescope is an acceptable means for visual inspection of ball valve regulators. Pilot regulators require the same internal inspection and part replacement policy as the main regulator body.

c. For all regulators, the spring color shall be checked to ensure it is the correct range and verified with the record card.

5. REMEDIATION

Appropriate action shall be taken to correct deficiencies found during the inspection. Regulator personnel shall not leave the work site until the regulators are in safe operating condition or taken out of service.

6. RECORDS

Records of each inspection shall be documented in the Company's work management system or other applicable records. The date and time of the inspection shall be recorded in the electronic WMS Job Order execution remarks field.

Inspection records shall be retained for a minimum of five (5) years, plus the current year.

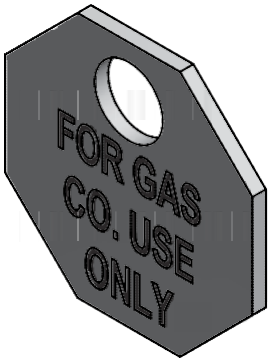
NiSource
Distribution Operations

Gas Standard

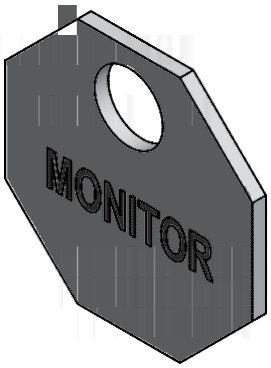
Effective Date: 01/01/2016	**Pressure Regulating Station Operation and Maintenance**	Standard Number: **GS 1750.010(KY)**
Supersedes: 8/01/2015		Page 6 of 6

EXHIBIT A

AVAILABLE TAGS



FOR GAS CO. USE ONLY
SCALE 1" = 1"



MONITOR SCALE
1" = 1"

WARNING DEVICE SCALE 1" = 1"

<u>These Tags can be ordered from</u>:

Columbus Meter Shop
metershop@nisource.com
Phone: (614) 460-5520

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2014	**Inspection and Maintenance of Delivery Station Regulators**	Standard Number: **GS 1750.020(KY)**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
	☑ CKY	☐ COH
	☐ CMA	☐ CPA

REFERENCE KY 807 KAR 5:006 Section 26(3)

1. GENERAL

This procedure applies to inspection and maintenance of fixed pressure factor measurement (FPFM) and variable pressure gas measurement billing (GMB) regulators.

2. FREQUENCY OF INSPECTION

2.1 FPFM Regulators

Verification of the service regulator set pressure (+/- 1% absolute specified delivery pressure) on FPFM accounts shall be performed as follows.

a. Accounts that are 2 psig or under AND have a meter capacity of 1.5 Mcfh or under, shall be verified at time of meter change or test.

b. Accounts that are greater than 2 psig OR have a meter capacity greater than 1.5 Mcfh shall be verified every five (5) years or according to specific state commission regulations, if more frequent.

NOTE: Meter capacities for diaphragm meters based on ½ - inch WC differential.

2.2 GMB Regulators

GMB regulators shall be inspected on the following frequency.

a. GMB regulators with ancillary pressure correcting or recording devices shall be inspected every 7 calendar years. Compensating indexes on meters are considered part of the meter function, and not considered ancillary correcting devices.

b. All other GMB regulators shall be inspected at the time of meter change or test.

c. Regulators can be inspected more frequently if local knowledge of operating conditions indicates a more-frequent inspection is necessary.

3. INSPECTION

All FPFM and GMB regulators shall be inspected to determine that they are:

a. in good mechanical condition,

b. set to control or relieve at the correct pressures, and

c. properly installed and protected from dirt, liquid, or other conditions that might prevent proper operation.

The purpose of the inspection is to determine conditions that may adversely affect the proper operation of the FPFM and GMB regulators and to make corrections by cleaning, replacement, or adjustment of parts, when necessary.

After pressure verification, the inspector should confirm that the FPFM pressure is correct in the company's billing system.

3.1 Regulator Test

Regulators shall be checked to ensure that they control pressure within expected and acceptable limits. The following checks shall be performed as follows.

a. Check the external condition of the regulator.

b. Check for any leaks on the regulator.

c. Check the regulator outlet pressure and adjust if necessary. If there is no flow, the outlet pressure check should be deferred until such time as a flow exists.

4. REMEDIATION

Prompt action shall be taken to correct deficiencies found during the inspection.

If the specified delivery pressure for FPFM regulators is not within the established tolerance of +/- 1% (absolute pressure), appropriate repairs and/or adjustments shall be made to the regulator.

Adjust GMB regulators to specified delivery pressure as needed.

5. RECORDS

Records of each inspection shall be documented in the Company's work management system or other applicable records. The date and time of the inspection shall be recorded in the electronic WMS Job Order execution remarks field.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Relief Devices Inspection and Maintenance**	Standard Number: **GS 1750.040(KY)**
Supersedes: 01/01/2014		Page 1 of 3

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
	☑ CKY	☐ COH
	☐ CMA	☐ CPA

REFERENCE 49 CFR Part 192.739; KY 807 KAR 5:006 Section 26(3)

1. GENERAL

This procedure applies to inspection and maintenance of relief devices located:

a. at pressure regulating stations,

b. within distribution and transmission systems, or

c. at customer delivery stations (e.g., M&R, GMB).

2. PRESSURE LIMITS

Except for LP systems and customer delivery stations, the relief device must be set to ensure that the outlet of the pressure regulating station does not go above the pressure limits in Table 1.

Table 1

MAOP	Allowable Build Up
12 psig or less	MAOP + 50%
12 psig to 60 psig	MAOP + 6 psig
Over 60 psig	MAOP + 10%, or 75% of SMYS, whichever is lower

For LP systems and customer delivery stations, relief devices should be set high enough to avoid operational issues but low enough as to assure the safe and continuing operation of any connected and properly adjusted equipment downstream.

3. FREQUENCY OF INSPECTION

Relief devices shall be inspected in accordance with Table 2.

Table 2

Relief Device Location	Frequency of Inspection
Pressure regulating stations and within distribution and transmission systems	Once each year not to exceed 15 months
Fixed Factor Customer Delivery Stations that are 2 psig or under AND have a meter capacity of 1.5 Mcfh or under	At time of meter change or test
Fixed Factor Customer Delivery Stations that are greater than 2 psig OR have a meter capacity greater than 1.5 Mcfh	Every five (5) years or according to specific state commission regulations, if more frequent
GMB Customer Delivery Stations with ancillary pressure correcting or recording devices	Every 7 calendar years
All other GMB Customer Delivery Stations	At time of meter change or test

4. INSPECTION

Relief devices shall be inspected to determine that all they are:

a. in good mechanical condition,

b. set to control or relieve at the correct pressures consistent with the pressure limits in accordance with Section 2 of this procedure, and

c. properly installed and protected from dirt, liquid, or other conditions that might prevent proper operation.

The purpose of the inspection is to determine conditions that may adversely affect the proper operation of the relief devices, and to make corrections by cleaning, replacement, or adjustment of parts, when necessary.

5. RELIEF DEVICE TEST

Each relief device, except for rupture discs, shall be tested to determine if the device is set to operate at the correct pressure. Relief devices that are removed from service for testing shall be tested in accordance with manufacturer's recommendations. Relief devices tested on site shall be tested in accordance with the following procedure.

5.1 Test Procedure

a. Check records for pressure at which relief device should relieve.

b. Isolate the relief device from the system it is designed to protect. In most cases, this can be done by unlocking and closing the valve ahead of the relief device.

c. Purge the piping between the inlet isolation valve and the relief device.

d. Connect a temporary line from a pressure supply to the piping between the relief device and the now closed valve ahead of it. This pressure supply may be existing gas pressure before a regulator, or a nitrogen bottle. This temporary line should have a pressure gauge on it.

e. Turn on the pressure supply and operate the relief device. Take note of the pressure at which the relief device relieves. Any serious deviation from the desired relief pressure should be corrected.

f. Shut off the supply pressure and observe the gauge still hooked into the piping before the relief device. A constant pressure reading on the gauge indicates a positive seal on the relief device.

g. Isolate the temporary piping used for the test and relieve pressure before disconnecting from the relief device piping.

h. If nitrogen is used as the test medium, bleed the test pressure from the relief device piping.

i. Open the valve ahead of the relief device and lock, or tag, with warning to prevent change of position.

6. REMEDIATION

Prompt action shall be taken to correct deficiencies found during the inspection. Personnel shall not leave the work site until the relief devices are in safe operating condition or taken out of service.

7. RECORDS

Records of each inspection shall be documented in the Company's work management system or other applicable records. The date and time of the inspection shall be recorded in the electronic WMS Job Order execution remarks field.

Inspection records shall be retained for the same period as the controlling regulators.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Bonding Considerations for Pressure Regulating and Point of Delivery Stations**	Standard Number: **GS 1750.050**
Supersedes: 03/01/2010		Page 1 of 2

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE None

1. GENERAL

All **Pressure Regulating Stations** and any non-residential Point of Delivery Stations shall have bonding cables installed whenever the work performed (breaking of metallic continuity, e.g., parting of a flange, piping, tubing, etc.) may cause an electrical arcing (insulated above ground). The bonding cables are installed to provide a path for the current while working on the setting.

The final bond connection shall be made in a non-flammable atmosphere.

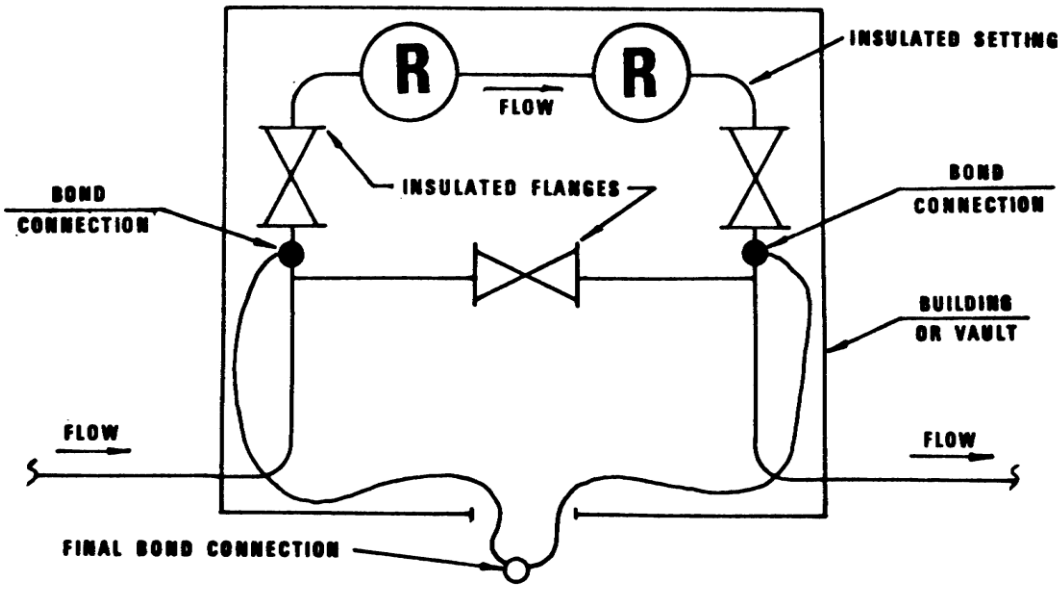
A #8 AWG stranded wire is the minimum size bonding wire to be used for bonding. A #2 AWG stranded wire is the minimum size wire to be used when bonding in stray current areas or in proximity of high voltage electric lines.

2. PREVENTING ELECTRICAL SHOCK

To reduce the risk of an electric shock, employees shall check the gas piping on both the inlet and outlet side of the setting with a volt meter, or at a minimum, with a non-contact voltage detector prior to any contact with the setting. Refer to GS 6500.100(xx) “Residential and Small Commercial Meter Requirements,” section 6, if voltage is detected.

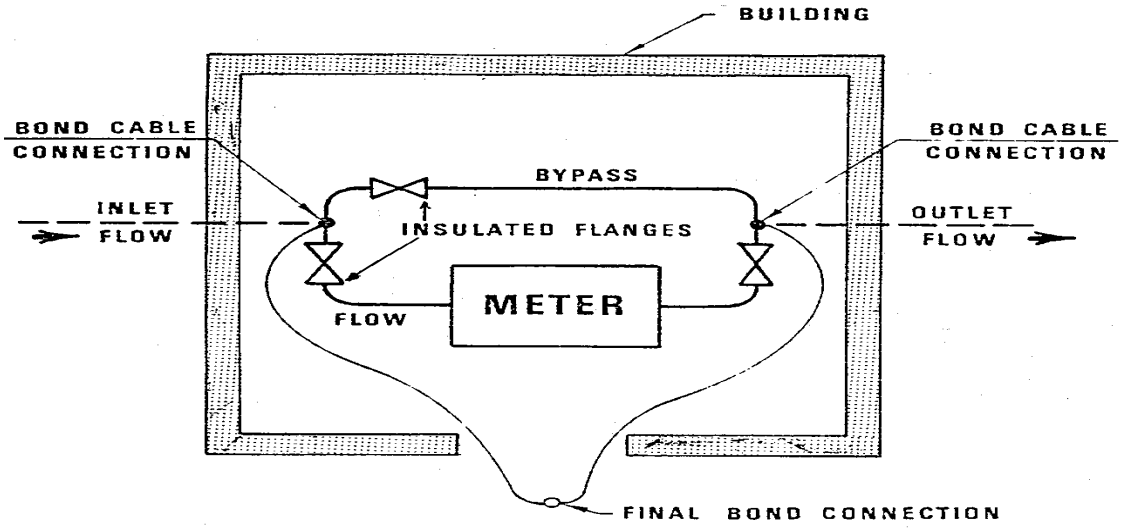
3. REGULATOR SETTINGS

The sketch below depicts a typical bond connection on an above ground insulated regulator setting located inside a building.



4. METER SETTINGS

The sketch below depicts a typical bond connection on an above ground insulated meter setting located inside a building.



BONDING CABLE CONNECTIONS FOR INSULATED METER SETTINGS

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Inspection and Maintenance of Heaters**	Standard Number: **GS 1750.210**
Supersedes: 08/01/2015		Page 1 of 13

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.739

1. GENERAL

This gas standard applies to the inspection, maintenance and remediation of heaters used in pipeline operations.

Natural gas temperature decreases approximately 1°F for each 15 psi drop. If the pressure drop is significant, internal and external icing conditions may result. When internal or external icing conditions are observed, the person making the observation shall notify the local Field Engineer. When a heater is present at the site, an indication of icing could either be the heater is in need of maintenance or the heater is undersized and needs to be retrofitted or replaced.

This standard applies to the following types of pipeline heaters:

a. Indirect fired water bath.
b. Catalytic.
c. Steam.
d. Kinetic Energy.

Unless otherwise noted in this standard, the maintenance of these heaters shall follow the manufacturer's written operating manual, if available.

2. INDIRECT FIRED WATER BATH HEATERS

Indirect water bath pipeline heaters are installed to reduce or prevent freezing of soil surrounding underground piping and resulting ground heaving downstream of regulator stations. In some instances they are installed to prevent hydrate formations internally in regulators, meters and pipelines when the gas contains excessive vapor or liquid phase hydrocarbons and water. Exhibit A pictures a typical water bath heater.

2.1 Accounting for Fuel Consumption

All indirect fired water bath heaters shall be equipped with a fuel meter. Fuel consumption for indirect fired water bath heaters can be significant and shall be accounted for in according to applicable Company procedures. It is important that

indirect water bath heaters be shut off when not required.

2.2 Fluids

2.2.1 Water Specifications

Water used for dilution or volumetric make up shall meet ASTM D1193 Type IV Reagent Water. Deionized water, Reverse Osmosis (RO) water or distilled water can meet this standard. Contact the manufacturer for water supply recommendations and specifications.

2.2.2 Heat Transfer Fluids (Glycol)

Automobile antifreeze with aluminum corrosion inhibitors silicone polymers SHALL NOT BE USED IN WATERBATH PIPELINE HEATERS. Industrial grade heat transfer fluids are available from the manufacturer in either concentrated or diluted solutions. The current approved heat transfer fluid for new line heaters is Dow's Norkool LTC. The fluid shall be ordered with a 50/50 mix of approved water and LTC. This fluid shall also be used when replacing the entire fluid in existing heaters.

For existing heaters with Dow Norkool SLH, make up fluid shall be a 50/50 mix of SLH and approved water. Replacement of the entire fluid with a 50/50 mix of LTC and approved water may be undertaken.

Replacement of the entire fluid for heater with neither LTC nor SLH may be undertaken with a 50/50 mix of LTC and approved water.

2.2.3 Fluid Mixture

A water bath mixture of 45% to 55% glycol by volume should be maintained at all times. A -35°F protection level can be obtained with a 50% glycol mixture. Ratios of glycol greater than 75% will increase the freezing temperature of the mixture, reduce efficiency and can create a potential fire hazard.

If it is necessary to add solution to an operating heater, it is recommended that a 50% glycol mixture be used. If glycol is not readily available, enough water should be added immediately to assure a safe operating level with follow-up testing to determine the quantity of glycol to add. In other cases, check for recommendations in the most recent analysis prior to adding solution.

When adding fluids where the original fluid supplier is known, use the same manufacturer's fluid. If the original fluid supplier is unknown, take fluid sample and have the sample laboratory tested. M&R leaders along with Field Engineering should review the laboratory analysis and make recommendations to adjust water bath solution.

2.2.4 Fluid Testing

The heat exchanger fluid shall be analyzed (tested) each year to determine the pH reserve alkalinity and water to glycol ratio. Additional samples may be submitted for analysis to confirm the effectiveness and accuracy of fluid additions and other fluid maintenance actions.

After analysis, M&R Leaders along with Field Engineering will make recommendations on quantities of water, glycol, and/or inhibitors to be added to restore the mixture to the targeted ratio.

The timing of the annual tests should be shortly after the fall start-up. It is recommended that a WMS Repetitive Task be established to ensure the timely testing of heat exchanger fluids.

Field locations should request the initial heat exchanger fluid sampling kit from the testing laboratory.

2.2.5 Fluid Maintenance Records

The testing laboratory should maintain a record of test results and recommendations given to operating personnel on heat exchanger fluids. Operating personnel should provide information on fluid additions made since the previous analysis when submitting fluid samples for testing. Systems Operations should maintain a record of tests results and recommendations from the testing laboratory.

2.3 Annual Inspections

Heaters shall be inspected at least once each calendar year not to exceed 15 months. It is recommended to perform this inspection just prior to the start of the heating season, as follows.

a. Inspect fire tube, main burner and pilot. Inspections should include corrosion inspection and inspect the fire tube for blockage.

b. Inspect liquid level to ensure it covers the tube bundle, both when the heater is cold and when it is operating.

c. Check for proper combustion.

    1. Flue conditions.

    2. Flame characteristics.

    3. Rated input by clocking the fuel meter.

d. Check water bath temperature controller setting. The high limit controller shall not exceed 180°F. Calibrate if necessary.

Note: The gas temperature controller located downstream of regulation should be set just above 32°F for good fuel economy.

e. Check insulated shell for condition and repair as required.

f. Inspect the flame arrestor for blockage. If required clean the flame arrestor with compressed air to insure enough air can pass to support combustion.

g. Check all safety and shut down switches and controllers for proper operation.

h. Check the rating of the pressure vessel to ensure it is appropriate for the operating conditions including.

1. Temperature and pressure ratings.
2. Ensure the heater is designed for its maximum allowable operating pressure and protected from over-pressuring including the fuel train.
3. Ensure the discharge from the flue stack is oriented away from any combustible items.

2.4 Remediation

Deficiencies found during the annual inspection program shall be corrected promptly to ensure that the intended function of the heater is being met.

If remedial action cannot be completed promptly, alternative actions must be implemented to ensure the safe and reliable operation of the pressure regulating station until the remedial actions of the heater can be completed.

3. CATALYTIC HEATERS

A catalytic heater is used to prevent internal freezing of regulators or meters. It does not add sufficient heat to the gas stream to prevent pipeline heaving.

Catalytic heaters are normally installed on high pressure cut regulator installations or M & R stations where wet gas conditions exist. Two types of catalytic heaters are available:

a. One (1) or two (2) catalytic heating elements mounted in enclosures that cover the regulator or meter body.

b. Larger, totally enclosed, rectangular “twin pack” heaters, mounted on three (3) inch or larger pipe, normally between regulators.

Where conditions or space permit, catalytic heating elements should be installed in an enclosure or housing. Heater enclosures for both types are used to increase heat transfer efficiency; they are made of stainless steel to reduce maintenance requirements. Catalytic heating elements which are enclosed transfer 50% more heat to the surface than unhoused heating elements. Heater enclosures also provide weather protection for outside

installations.

Gas used in catalytic heater operations shall be accounted for on Form GS 1750.810-2 "Estimate of Unmeasured Gas Used for Regulator Operations" in accordance with applicable procedures.

To provide operational flexibility and to reduce fuel consumption during summer operations, a "Fuel Turn Down" valve should be incorporated on all new catalytic heater installations. The "Fuel Turn Down" valve is sized according to the BTU rating of the heater. On existing heaters with dual heating elements, fuel consumption can be reduced by turning of the fuel shut-off valve to one heating element during periods of low demand.

Installation, starting, and maintenance instructions for catalytic heaters are found on the Gas Operation Training page of MySource, under Technical Training "System Ops" and is listed under Student Guides as "Operating and Maintaining Catalytic Heater Installations (CDOPM4H.1)."

Catalytic heaters have no moving parts and the fuel regulators are set at the factory.

Exhibit B illustrates typical examples of the two types of catalytic heater installations.

3.1 Annual Inspections

Catalytic heaters shall be inspected at least once each calendar year not to exceed 15 months. It is recommended to perform this inspection just prior to the start of the heating season, as follows.

a. Inspect the wiring terminals and clean with emery cloth.

b. Inspect the enclosure if equipped for any deficiencies and repair or replace.

c. Visually inspect the piping and regulators for any signs of wear which would require replacement.

d. Inspect the heater face and catalyst pad for debris or water. It may be necessary to dry heater in oven if water is present. Follow the manufacturer recommendations when drying catalyst pad.

e. Verify that the inlet pressure to the supply regulator has not changed since last use. It may be necessary to add an upstream regulator to the supply lines if pressure has been increased.

3.2 Remediation

If heater does not stay lit follow the steps below.

1. Verify the operating pressure downstream of the final cut regulator (3.5 - 4.5 inches w. c.).

2. Verify all orifices are clear.
3. Verify safety shut-off valve is open by depressing the red reset button.
4. Verify the connections of the thermocouple are tight at the safety valve and heater pan.
5. Verify the heating element for electric continuity.

Deficiencies found during the annual inspection program shall be corrected promptly to ensure that the intended function of the heater is being met.

If remedial action cannot be completed promptly, alternative actions must be implemented to ensure the safe and reliable operation of the pressure regulating station until the remedial actions of the heater can be completed.

If the heater will still not operate, it should be replaced or returned to the manufacturer for repair.

4. STEAM HEATER

Steam heaters use steam from a water / glycol mixture to apply heat to the gas with the gas stream piping. The water mixture is heated in a vacuum which allows the water to boil into a steam at a lower temperature which reduces fuel costs. Exhibit C pictures a steam heater with the boiler and the steam tubes.

4.1 Accounting for Fuel Consumption

All steam heaters shall be equipped with a fuel meter. Fuel consumption for steam heaters can be significant and shall be accounted for in according to applicable Company procedures. It is important that steam heaters be shut off when not required.

4.2 Fluids

4.2.1 Water Specifications

Water used for dilution or volumetric make up shall meet ASTM D1193 Type IV Reagent Water. Deionized water, Reverse Osmosis (RO) water or distilled water can meet this standard. Contact the manufacturer for water supply recommendations and specifications.

4.2.2 Heat Transfer Fluids (Glycol)

Automobile antifreeze with aluminum corrosion inhibitors silicone polymers SHALL NOT BE USED IN STEAM PIPELINE HEATERS. Industrial grade heat transfer fluids are available from the manufacturer in either concentrated or diluted solutions. The current approved fluid for steam heaters is Dowfrost HD

manufactured by Dow Chemical.

4.2.3 Fluid Mixture

A water bath mixture of 45% to 55% glycol by volume should be maintained at all times. A -35°F protection level can be obtained with a 50% glycol mixture. Ratios of glycol greater than 75% will increase the freezing temperature of the mixture, reduce efficiency and can create a potential fire hazard.

If it is necessary to add solution to an operating heater, it is recommended that a 50% glycol mixture be used. If glycol is not readily available, enough water should be added immediately to assure a safe operating level with follow-up testing to determine the quantity of glycol to add. In other cases, check for recommendations in the most recent analysis prior to adding solution.

When adding fluids where the original fluid supplier is known, use the same manufacturer's fluid. If the original fluid supplier is unknown, take fluid sample and have the sample laboratory tested. Field Engineers should review the laboratory analysis and make recommendations to adjust water bath solution.

4.2.4 Fluid Testing

The heat exchanger fluid shall be analyzed (tested) after the first year. If analysis indicates no remedial actions required, sampling shall be completed every five (5) years until the sample results indicate remedial actions are required. The sample should be taken before the heater is lit for the year or shut off over night before the sample is taken. Additional samples may be submitted for analysis to confirm the effectiveness and accuracy of fluid additions and other fluid maintenance actions. If after the first three (3) year worth of samples indicates no issue with the fluid, the annual fluid testing can be eliminated.

After analysis, Field Engineering will make recommendations on quantities of water, glycol, and/or inhibitors to be added to restore the mixture to the targeted ratio.

The timing of the annual tests should be shortly before the fall start-up. It is recommended that a WMS Repetitive Task be established to ensure the timely testing of heat exchanger fluids.

Field locations should request the initial heat exchanger fluid sampling kit from the testing laboratory.

4.2.5 Fluid Maintenance Records

The testing laboratory should maintain a record of test results and recommendations given to operating personnel on heat exchanger fluids.

Operating personnel should provide information on fluid additions made since the previous analysis when submitting fluid samples for testing. Systems Operations should maintain a record of tests results and recommendations from the testing laboratory.

4.3 Annual Inspections

Heaters shall be inspected at least once each calendar year not to exceed 15 months. It is recommended to perform this inspection just prior to the start of the heating season, as follows.

a. Inspect fire tube, main burner, pressure coil and pilot. Inspections should include corrosion inspection and fire tube blockage inspection.

b. Inspect liquid level to ensure it covers the tube bundle, both when the heater is cold and when it is operating.

c. Check for proper combustion.

   1. Flue conditions.
   2. Flame characteristics.
   3. Rated input by clocking the fuel meter.

d. Check water bath temperature controller setting. Calibrate if necessary.

   Note: The gas temperature controller located downstream of regulation should be set just above 32°F for good fuel economy.

e. Check insulated shell for condition and repair as required.

f. Clean the flame arrestor with compressed air to insure enough air can pass to support combustion.

g. Check all safety and shut down switches and controllers for proper operation.

h. Inspect the vacuum gauge for proper vacuum pressure. A vacuum pressure of minus 5 to minus 15 inches of mercury during operation or minus 20 to minus 29 inches of mercury during shut down are good indication of proper vacuum pressures.

4.4 Remediation

Deficiencies found during the annual inspection program shall be corrected promptly to ensure that the intended function of the heater is being met.

If remedial action cannot be completed promptly, alternative actions must be implemented to ensure the safe and reliable operation of the pressure regulating station until the remedial actions of the heater can be completed.

5. KINETIC ENERGY HEATERS

Kinetic energy heaters (e.g., VORTEX) rely on the increase in flow rate of the heater's supply gas to provide heat to the gas stream. Exhibit D pictures a heater and a typical installation.

5.1 Annual Inspections and Maintenance

The heater itself has no moving parts. Other maintenance and inspection should be completed before the fall heating season.

a. Inspect and clear if necessary all control, supply and gas stream lines.

b. Inspect and reset the heater supply control valve to the proper pressure.

c. IF so equipped, inspect and reset the flow control regulator to the proper pressure.

d. Inspect, clean or replace if necessary the gas stream filter.

EXHIBIT A

Water Bath Heater

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Inspection and Maintenance of Heaters**	Standard Number: **GS 1750.210**
Supersedes: 08/01/2015		Page 11 of 13

EXHIBIT B

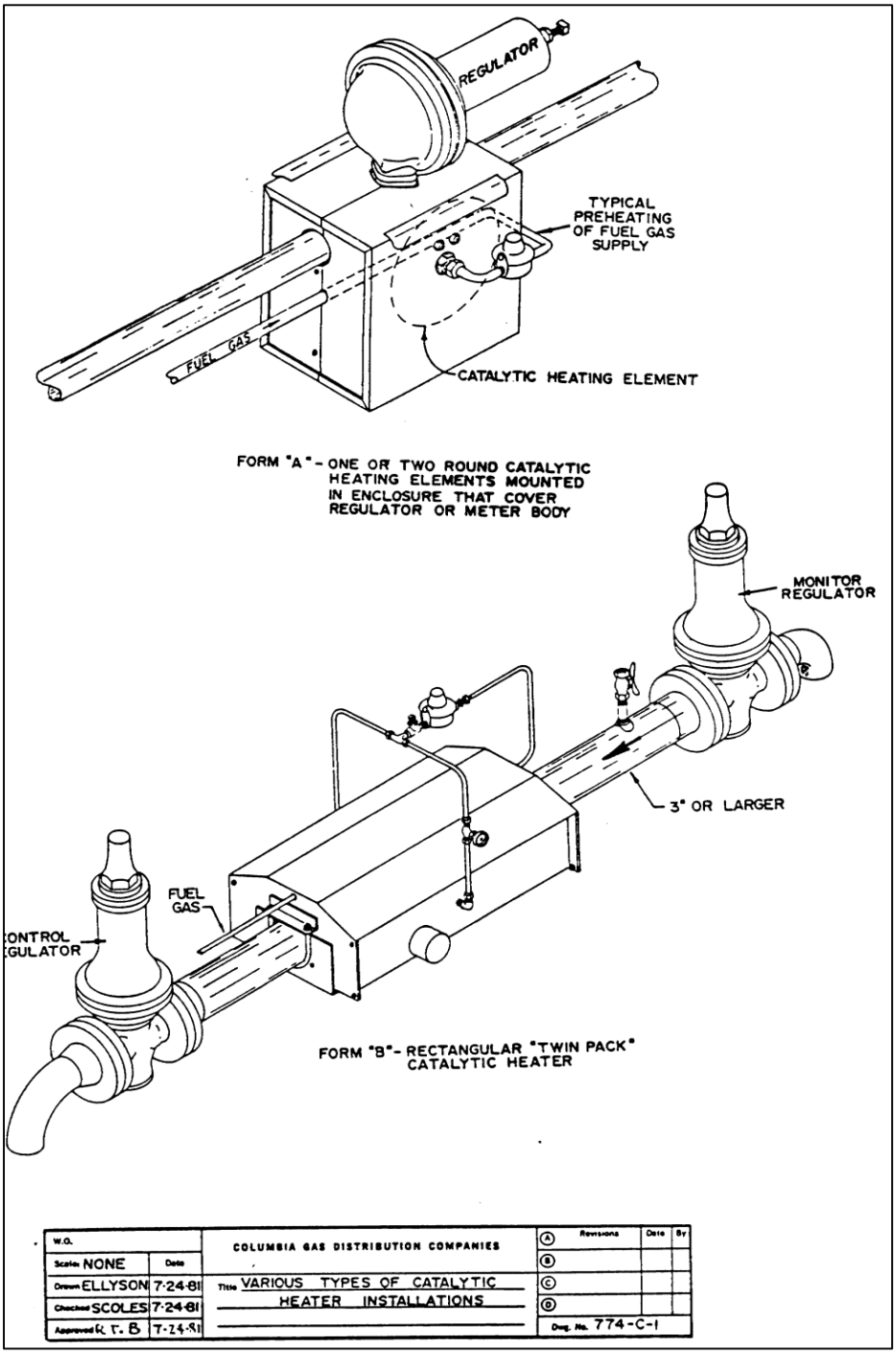
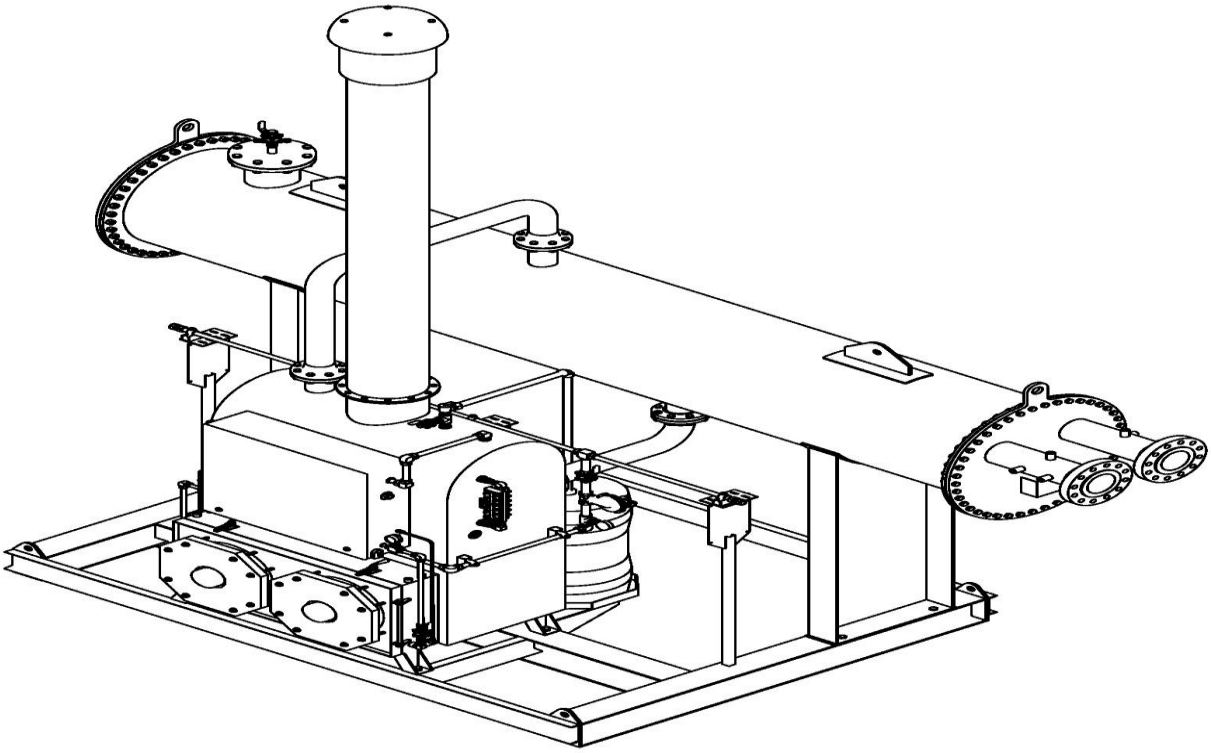


EXHIBIT C

Steam Heater



Effective Date: 01/01/2016	**Inspection and Maintenance of Heaters**	Standard Number: **GS 1750.210**
Supersedes: 08/01/2015		Page 13 of 13

EXHIBIT D

Kinetic Energy Type Heater

Typical Installation with Downstream Flow Control Regulator

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Records and Reports for Regulation**	Standard Number: **GS 1750.810**
Supersedes: 12/05/2005		Page 1 of 8

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE CFR - Title 49 - Part 192 - § 192.603

1. REGULATOR STATION INVENTORY RECORD CARD

Records of regulator station inventory shall be documented and maintained in the company's computer-based work management system for each Town Border or District Regulator Station. A form entitled "Regulator Station Inventory Record Card," (see Exhibit A), shall be generated for each Town Border or District Regulator Station. A copy of the form shall be placed at the regulator station.

A legible isometric sketch (see Exhibit A, page 3) indicating piping configuration for all station operation shall be maintained at the station and at a location accessible to the regulator maintenance personnel or operations leadership. The exterior shut off valve(s) shall be included on the sketch or a copy of the critical valve location sketch, if applicable, may be used.

2. FORM GS 1750.810-1, "REGULATOR STATION INSPECTION RECORD"

Form GS 1750.810-1, (see Exhibit B), shall be prepared and placed in each Town Border and District Regulator Station. The form shall be maintained by the personnel responsible for the operation, maintenance, and inspection of the regulator station and all associated equipment at the site.

After the last entry is made (front- and back-side), the form shall be filed at an appropriate operations location, and retained for a period of three (3) years form the date of the last entry.

3. FORM GS 1750.810-2, "ESTIMATE OF UNMEASURED GAS USED FOR REGULATOR OPERATIONS"

Form GS 1750.810-2, (see Exhibit C), shall be completed for each regulator station owned by the Company and using unmeasured gas for regulator heaters and/or pressure controllers. Form GS 1750.810-2 shall also be prepared when a Company owns the gas and another company owns the regulator station. Form GS 1750.810-2 shall not be prepared when another company owns the gas used for their own operation, regardless of who operates the station.

Form GS 1750.810-2 will be used initially to establish an account on the DIS file, or an

equivalent tracking method. Thereafter, Form GS 1750.810-2 shall be reviewed and updated annually to reflect the station consumption for the succeeding calendar year. The original copy of Form GS 1750.810-2 shall be maintained at the appropriate location, and a copy, when updates are made, forwarded to Accounting for processing according to applicable Company procedures.

EXHIBIT A
(1 OF 3)

COLUMBIA GAS DISTRBUTION COMPANIES — PAGE 1 OF 2
WORK MANAGEMENT SYSTEM — FILE WLB4210
REGULATOR STATION INVENTORY RECORD CARD — DATE 09/09/94
REGULATOR STATION NO: 123456 — TIME 10:30

STATION NAME: BEAR RUN DISTRICT STATION — STATION TYPE: DISTRICT
LOCATED NEAR OR AT: 1234 BEAR RUN ROAD
STATE: OHIO — COUNTY: FRANKLIN — TOWNSHIP/MUNICIPALITY: COLUMBUS
TAXING DISTRICT MUNBER: 1234567 — MAP NUMBER: 1234567898
COMPANY PREMISE ID: 1234567

STRUCTURE AND LOT

FACILITY ID: 1234567890
TYPE OF STRUCTURE: BUILDING — BULIDING NUMBER: 123456789
STRUCTURE SIZE: 16 X 16 — STRUCTURE TYPE: PRE-CAST
TYPE AND SIZE VENTILATION: NATURAL - LOUVERS 225 IN.
ELECTRICAL EQUIPEMENT IN BUILDING: N/A
SIZE OF LAND: 123 X 456 X 789 X 123 — LAND OWNED BY: LESSOR
DEAD LEASE OR EASEMENT NUMBER: L-515 — LEASE EXP. DATE: 09/09/96

HEATER/GAS CLEANER

	FAC ID	MANUFACTURE	TYPE	RATE
HEATER	1234567890	ENERTEK	WATER BATH	4MM
GAS CLEANER	1234567890	COLUMBIA	SCRUBBER	150GAL
GAUGE	1234567890	BRISTLE	RECORDING	31DAY

PIPING SYSTEM	LINE NUMBER	DESIGN PRESSURE	MAOP	MIN COMM PRESSURE
INLET LINE	1804	1650	1100	900
OUTLET LINE	CDC	225	150	120
OUTLET LINE	CDC	180	120	100
OUTLET LINE	CDC	180	120	85

FUNCTION ID: 123456789

VALVES

	FAC ID	VALVE NUM	TYPE	PIPE SIZE	SYS NUM	TYPE OF END	BOOK NUM
VLV 1	01234567890	0123456789	BALL	020	34100069	WELD	12345678
VLV 2	01234567890	0123456789	GATE	020	34100069	SCREW	12345678
VLV 3	01234567890	0123456789	BUTTERFLY	030	34100069	FLANGE	12345678
VLV 4	01234567890	0123456789	BALL	030	34100069	SCREW	12345678

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Records and Reports for Regulation**	Standard Number: **GS 1750.810**
Supersedes: 12/05/2005		Page 4 of 8

EXHIBIT A
(2 OF 3)

COLUMBIA GAS DISTRBUTION COMPANIES — PAGE 2 OF 2
WORK MANAGEMENT SYSTEM — FILE WLB4210
REGULATOR STATION INVENTORY RECORD CARD — DATE 09/09/94
REGULATOR STATION NO: 123456 — TIME 10:30

STATION NAME: BEAR RUN DISTRICT STATION — STATION TYPE: DISTRICT
LOCATED NEAR OR AT: 1234 BEAR RUN ROAD
STATE: OHIO — COUNTY: FRANKLIN — TOWNSHIP/MUNICIPALITY: COLUMBUS
TAXING DISTRICT MUNBER: 1234567 — MAP NUMBER: 1234567898
COMPANY PREMISE ID: 1234567

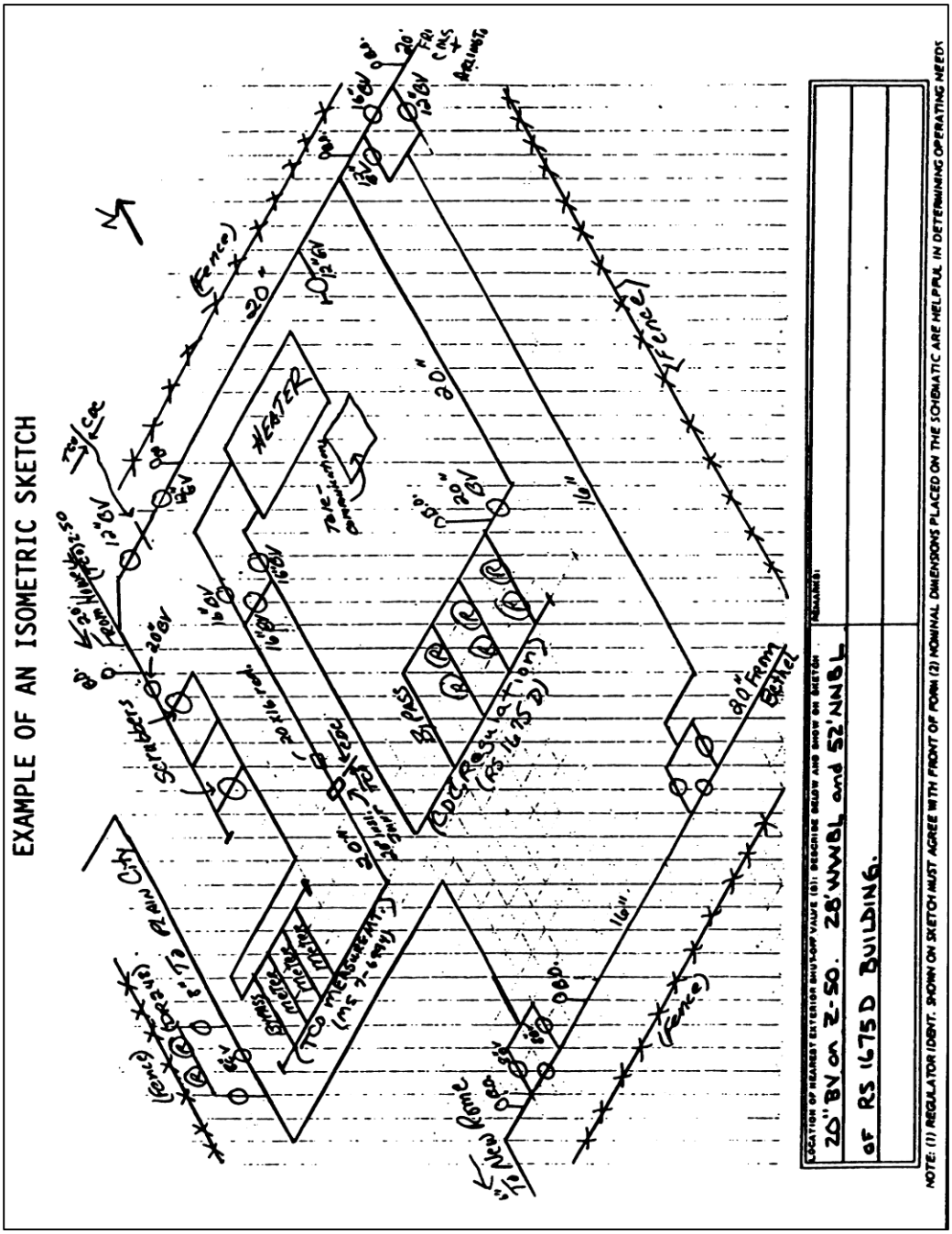
	REG FAC ID 1234567890 SEQ 40	REG FAC ID 1234567890 SEQ 50
MANUFACTURE	AM	BK
MODEL NUMBER	123456789078909	1234567890987
SERIAL NUMBER	1234567890	2345678901
FUNCTION OF REGULATOR	MON	CON
DESIGN PRESSURE OF BODY	175	575
DESIGN PRESSURE AS ASSEMBLED	100	200
INLET TYPE	FLANGE	SCREW
OUTLET TYPE	WELD	SCREW
INLET/OUTLET SIZE	2 X 2	3 X 2
INNER VALVE SIZE	2 1/2	3 1/2
VALVE TYPE	SPQO	SPVP
SEAT TYPE	HARD	SOFT
DIAPHRAGM CASE SIZE	2	4
CONTROL SYSTEM		
TYPE CONTROLS	PIO	LEV
SPRING COLOR	RED	RED
SPRING RANGE	7-16"	7-18"
OPER PRESSURE RANGE		
INLET MAXIMUM	130	135
OUTLET MAXIMUM	120	125

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Records and Reports for Regulation**	Standard Number: **GS 1750.810**
Supersedes: 12/05/2005		Page 5 of 8

EXHIBIT A
(3 OF 3)



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Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Records and Reports for Regulation**	Standard Number: **GS 1750.810**
Supersedes: 12/05/2005		Page 6 of 8

EXHIBIT B

Form GS 1750.810-1 (01/2016)

REGULATOR STATION INSPECTION RECORD

COMPANY	STATION NAME	STATION NUMBER	INSPECTION SCHEDULE
TOWN OR TOWNSHIP	COUNTY	STATE	OPERATING CENTER

STATION DESIGNATION ❑ TRANSMISSION ❑ COMPANY TOWN BORDER ❑ DISTRICT ❑ MUNICIPAL, INDUSTRIAL, OR COMMERCIAL ❑ OTHER (SPECIFY)

DATE	TIME	PURPOSE *			CONTROL PRESSURE SETTING	MONITOR PRESSURE SETTING	INSPECTOR'S SIGNATURE	REMARKS
		R.C.	S.I.	P.C.				
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* R.C. – ROUTINE CHECK * S.I. – SCHEDULED INSPECTION * P.C. – PRESSURE CHANGE

NOTE: Form GS 1750.810-1 may be ordered from the Dupli online catalog.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Records and Reports for Regulation**	Standard Number: **GS 1750.810**
Supersedes: 12/05/2005		Page 7 of 8

EXHIBIT C
(1 OF 2)

NiSource

ESTIMATE OF UNMEASURED GAS USED FOR REGULATOR OPERATIONS

ESTIMATE YEAR	YEAR	YEAR	YEAR	YEAR	YEAR	YEAR
PURPOSE CODE NA-NEW ACCOUNT, R-REVISION, NC-NO CHANGE	NA-R-NC	R-NC	R-NC	R-NC	R-NC	R-NC
CUSTOMER NAME ☐ CKY ☐ COH ☐ CMD ☐ CPA ☐ CGV ☐ CMA ☐ OTHER (Specify): _____	PREPARED BY (ENTER INITIALS)					

LOCATION NAME AND NO.	UNIT	BOOK	MAIN NUMBER	TAXING DISCTRICT	PSID	DATE ORDER EXEC

KIND/SIZE	NUMBER	READING	NO. DIALS	REV. CL.	MTR. LOC.	ACCT. CL. (Keyword Service)	CO. USE NO. (Keyword Customer)	UNMTRD. GAS TYPE (Keyword UNMTR)	Monthly EST CCF (Keyword UNMTR)
999	UNMTRD	0000	4	41		70		7	

SERVICE ADDRESS

STREET	REGULATOR STATION NO.

CITY	STATE	ZIPCODE

MAILING ADDRESS

STREET		
CITY	**STATE**	**ZIPCODE**

NUMBER HEATERS OR CONTROLLERS (a)	EQUIPMENT DESCRIPTION * (b)	MONTHLY CCF USAGE PER ELEMENT * (c)	NUMBER HEATER ELEMENTS OR CONTROLLERS (d)	MONTHS USED (e)	ANNUAL CCF USAGE (c x d x e) (f)
	PRESSURE CONTROLLER	44			
TOTAL ANNUAL CCF USAGE					
AVERAGE MONTHLY CCF USAGE	(TOTAL ANNUAL USAGE / 12)		ROUND TO NEAREST WHOLE NUMBER		

* SEE REVERSE SIDE

Form GS 1750.810-2 (01/2016)

NOTE: Form GS 1750.810-2 may be ordered from the Dupli online catalog

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Records and Reports for Regulation**	Standard Number: **GS 1750.810**
Supersedes: 12/05/2005		Page 8 of 8

EXHIBIT C
(2 OF 2)

MONTHLY GAS USAGE FOR CATALYTIC HEATER ELEMENTS AND PRESSURE CONTROLLERS

$i = 1000, 1500 \ldots 12000$ — BTU input rating Range of catalytic heaters

$$V_{1_i} = \frac{(i)\cdot(24)\cdot(30)}{1000}$$ — Volume consumed for 24 hours and a 30 day period

$$V_{2_i} = \frac{(i)\cdot(0.15)\cdot(24)\cdot(30)}{1000}$$ — Volume consumed at a reduced rate for 24 hours and a 30 day period. Catalytic heaters are reduced to 15% of their rated input for reduced operation in the summer.

BTU/Hr Rating Per Element	Monthly usage in Cu Ft Per Element	
	Full Open	Reduced Flow
i	V_{1_i}	V_{2_i}
1000	720	108
1500	1080	162
2000	1440	216
2500	1800	270
3000	2160	324
3500	2520	378
4000	2880	432
4500	3240	486
5000	3600	540
5500	3960	594
6000	4320	648
6500	4680	702
7000	5040	756
7500	5400	810
8000	5760	864
8500	6120	918
9000	6480	972
9500	6840	1026
10000	7200	1080
10500	7560	1134
11000	7920	1188
11500	8280	1242
12000	8640	1296

PRESSURE CONTROLLERS BLEEDING TO ATMOSPHERE (RATED AT 6000 BTU) CONSUME 4400 CUBIC FEET OF GAS ON A MONTHLY BASIS

Company Use Code

31**# Regulator Heater-Unmetered-District Regulator
32**# Regulator Heater-Unmetered-Service Regulator
33**# Regulator Heater-Unmetered-Town Border Regulator

\# Used for additional sub-division of Company Use Number. Use zero unless codes are assigned by mutual agreement of the District Office and General Accounting Section

** Local Taxing Authority Applicable to those areas which have School Tax and/or Franchise Fees in Kentucky. See Section F of Account Classification Manual. Other areas use zeros.

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Gas Standard

Distribution Operations

Effective Date: 01/01/2014	**Pressure Regulating Station Capacity Review**	Standard Number: **GS 1752.010**
Supersedes: 01/01/2010		Page 1 of 2

Companies Affected:

☑ NIPSCO Effective: 01/01/2015	☑ CGV ☑ CKY ☑ CMA	☑ CMD ☑ COH ☑ CPA

REFERENCE None

1. GENERAL

Each regulator in a **pressure regulating station** that is inspected and tested in accordance with GS 1750.010 “Pressure Regulating Station Inspection and Maintenance” shall be reviewed by Engineering to ensure that it is adequate from the standpoint of capacity.

This requirement is met by an annual review of all pressure regulating stations where conditions or equipment have changed during the year. Changes such as inlet pressure, regulator type and orifice size may affect the capacity of a regulator.

2. PRESSURE REGULATING STATION CAPACITY REVIEW

The following methods are used to determine the adequacy of a pressure regulating station’s capacity:

a. evaluating pressure charts or telemetering data for indications of low pressure,

b. reviewing network analysis models to assess whether the capacity of each modeled regulator will be adequate to meet peak design day requirements, and

c. reported loss of service.

3. RESPONSIBILITY

Field Engineering is responsible for seeing the annual review is completed and documented.

When the review indicates that a regulator is approaching its capacity or the capacity of the regulator is inadequate, the local Field Engineer should work with System Operations to develop a plan to remedy the condition (e.g. upstream betterment, bypassing the regulators during certain conditions, increasing the orifice in the regulator, replacing the regulator, adding an additional pressure regulating station, etc.). Any identified deficiencies should be addressed during the winter operations meetings if not already remediated.

System Operations shall notify the Operation Center Manager and the local Field Engineer of any upstream or downstream inadequate pressure observed at regulating stations. System Operations shall also note any other known changes that could affect the capacity

MiSource

Gas Standard

Distribution Operations

Effective Date: 01/01/2014	**Pressure Regulating Station Capacity Review**	Standard Number: **GS 1752.010**
Supersedes: 01/01/2010		Page 2 of 2

of the regulator station.

4. FREQUENCY

The pressure regulating station capacity review must be conducted once each calendar year at intervals not to exceed 15 months.

5. RECORDS

The review must be documented (e.g. by saving report or files from network analysis sessions). Documentation shall be retained for two (2) years, plus the current year, except for regulators associated with transmission lines which shall be retained for five (5) years, plus the current year. Documentation will be retained in the field.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Operation and Maintenance of Pressure Gauges**	Standard Number: **GS 1754.010(KY)**
Supersedes: 08/01/2015		Page 1 of 5

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
	☑ CKY	☐ COH
	☐ CMA	☐ CPA

REFERENCE None

1. GENERAL

This gas standard sets forth the requirements for operation and maintenance of pressure gauges.

2. DEFINITIONS

"Annually" means once in a dated year. For example, a portable gauge for fixed factor metering calibrated in May 2014 may be recalibrated at any time in 2015 - January through December.

"Once a calendar year but not to exceed 15 months" means there is a 15 month limit for recalibration interval but the interval cannot span three different years. For example, a permanently mounted gauge at a pressure regulating station calibrated on May 15, 2014 must be recalibrated by August 15 2015. A gauge calibrated on December 15, 2014 must be recalibrated before December 31, 2015.

3. INSPECTION OF PRESSURE GAUGES

Pressure gauges shall be inspected in accordance to Table 1:

Table 1				
Type of Gauge	**Inspection Interval**	**Required Accuracy of Gauge Range**	**Test Points of Element Range**	**Calibration Device***
Portable indicating ("spring-type") and recording gauges	Once each calendar year but not to exceed 15 months	± 2%	Zero, 10% Full Scale Midpoint, Minimum 90% of Full scale	A or B
Permanently mounted gauges at pressure regulating stations and within distribution and transmission systems	Once each calendar year but not to exceed 15 months	± 2%	Operating pressure, Mid-point between operating pressure and zero, At zero	B
FPFM recording gauges	Once each calendar year	± 0.5%	Zero, Midpoint, Full scale	A or B

*Calibration Device Code:

A - Deadweight tester/gauge
B - Electronic Testing/Calibration Devices

Spring gauges shall be numbered and dated with the last calibration date and the next calibration due date. A listing of pressure gauges (Form GS 1754.010-1 “Pressure Gauge Inspection Record”) shall be kept at the local operating office (refer to Exhibit A). This form may be kept electronically.

4. CERTIFICATION OF CALIBRATION DEVICES

The supervisor or designee shall be responsible to ensure Company certification of calibration devices in accordance with Table 2. Certification shall be performed by a check against a certified reference standard. A dated record of all scheduled and performed tests shall be maintained. The schedules, shown in Table 2, shall be in effect, except where state regulatory requirements are more stringent. In such instances, the more stringent schedule shall take precedence.

Table 2		
Type of Equipment	**Required Accuracy**	**Schedule***
	± 0.1% of Reading	Continuous and annually

Table 2		
Type of Equipment	**Required Accuracy**	**Schedule***
Electronic Digital Pressure Indicator	± 0.1% Full Scale	
Deadweight Tester/Gauge	± 0.1% of Indicated Pressure	Continuous and every 3 years

*NOTE: A continuous schedule requires a visual inspection for defects, damage, and abnormal operation prior to, or during, each use.

Equipment suspected to be operating abnormally should be checked against a similar device to determine if calibration is needed.

Equipment that does not meet the required accuracy shall be calibrated to a reference standard.

New deadweight testers/gauges and electronic testing/calibration devices shall be certified by the manufacturer. This certification is acceptable until the scheduled recertification is due according to Table 2.

Certification shall be accomplished at an appropriate Company or outside testing facility.

Upon completion of calibration tests for certification, the testing facility will provide a record of the calibration. The responsible supervisor shall retain this record according to Company retention requirements.

5. MONITORING AND EVALUATON OF TELEMETERING AND RECORDING GAUGES LOCATED AT PRESSURE REGULATING STATIONS

5.1 Monitoring

Systems Operations M&R personnel shall monitor telemetering and recording pressure gauges on a periodic basis to determine if there are indications of abnormally high or low pressures.

For telemetering gauges monitored through the SCADA system, Gas Control is responsible to determine if there are indications of abnormally high or low pressures at these sites.

5.2 Evaluation of Recording Gauge Charts and Telemetering Data

The person performing the work shall evaluate the chart or telemetering data to determine if there are indications of abnormally high or low pressures including any excursions above the MAOP. If indications exist, the Systems Operations supervisor

shall be notified immediately. All charts shall be reviewed by a supervisor or designee for operational inconsistencies.

The Systems Operations supervisor shall be responsible for initiating any corrective action. Unusually low pressures should be brought to the attention of Engineering. If pressure adjustments are necessary, Engineering should initiate the change.

6. MAINTENANCE

If there are indications of abnormally high or low pressure, the regulator and the other equipment shall be inspected. Necessary measures shall be taken to correct any unsatisfactory operating conditions.

Systems Operations should use the appropriate chart for the specific recording gauge. Recording charts that provide the sole or primary means of monitoring system pressure should be changed at intervals that coincide with the chart duration (e.g. a seven-day chart should be changed weekly, a thirty-one-day chart should be changed monthly, etc.). The station location, the time and date of the installation and time and date of removal should be recorded on the chart. Recording charts which provide a redundant or secondary means of monitoring system pressure (e.g. seasonal charts) should be changed periodically.

7. RECORDS

Recording pressure charts and telemetering reports associated with distribution systems shall be retained for a minimum of two (2) years, plus the current year.

Records associated with calibration devices shall be retained until the next certification.

In order to eliminate the confusion created by different types of pressure reading devices and to prevent possible pressure documentation problems in relation to exceeding MAOP, the following policy has been adopted:

a. The electronically read pressures will be the official pressures for documentation purposes at stations which are monitored through the SCADA system; and

b. Pressures read by mechanical devices will be the official pressures for documentation purposes at stations that are manually controlled.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Operation and Maintenance of Pressure Gauges**	Standard Number: **GS 1754.010(KY)**
Supersedes: 08/01/2015		Page 5 of 5

EXHIBIT A

NISOURCE

PRESSURE GAUGE INSPECTION RECORD

INSPECTION INTERVAL:		OPERATING CENTER:		LOCATION NUMBER:					
GAUGE MANUFACTURER	TYPE Indicating or Recording	GAUGE NUMBER	GAUGE RANGE	INSPECTION INFORMATION					
				Date	Initials	Date	Initials	Date	Initials

Form GS 1754.010-1 (01/2016)

NOTE: Form GS 1754.010-1 may be ordered from the Dupli online catalog or downloaded from the Gas Distribution Standards MySource site.

NiSource

Gas Standard

Distribution Operations

Effective Date: 01/01/2010	**Annual Review of Primary Relief Devices**	Standard Number: **GS 1756.010**
Supercedes: N/A		Page 1 of 9

Companies Affected:

☐ NIPSCO	☑ CGV ☑ COH	☑ BSG
☐ NIFL	☑ CKY ☑ CPA	
☐ Kokomo Gas	☑ CMD	

1. GENERAL

This procedure applies only to those relief devices that provide the only means (primary) to protect the pressure regulating station from accidental over-pressurization of the downstream piping system. Over-pressurization occurs when the gas pressure exceeds the maximum operating pressure (MOP) of the piping system plus the allowable build-up, as defined by GS 1750.040 "Relief Device Inspection and Maintenance," Table 1. Refer to GS 1660.020 "Maximum Allowable Operating Pressure (MAOP)" for guidance regarding MOP and MAOP. These relief devices are referred to as **primary relief devices**.

Primary relief devices must have sufficient capacity to protect the facilities to which they are connected and must have pressure ratings of at least the downstream piping system MOP plus the allowable build-up.

The capacity of each primary relief device shall be reviewed and determined once each calendar year at intervals not to exceed 15 months.

Field Engineering is responsible for performing the annual review and determining the capacity for each primary relief device. Typically, the primary relief device capacity is verified by review and/or calculations.

Relief devices which do not provide the primary means of overpressure protection do not require an annual capacity review.

2. PRIMARY RELIEF DEVICE CAPACITY REVIEW AND/OR CALCULATION

If review and/or calculations are used to determine if a primary relief device has sufficient capacity, the calculated capacity of the pressure regulating station must be compared with the capacity of the primary relief device for the conditions under which it operates.

A review and/or calculations are required initially when a primary relief device is designed for installation and subsequently when parameters of a pressure regulating station change. M&R personnel shall inform local Engineering personnel when parameters are changed at a pressure regulating station containing a primary relief device. Examples of parameters that could affect the capacity of the relief valve include, but are not limited to:

a. change of regulator,

b. change in regulator orifice size,

c. change in set point of the regulator and/or relief valve,

d. change in the stack design or vent sizing,

NOTE: Vent lines, if particularly long or swaged-down, will cause a backpressure, thus reducing the capacity of the relief device. Refer to CDC M&R Handbook or existing gas standards for guidance on vent sizing.

e. change in MOP or MAOP to the inlet or outlet system of a pressure regulating station, or

f. other change that will affect the overpressure protection requirements of the primary relief device capacity.

Capacity calculations are not required if the annual review determines that parameters that affect the primary relief device capacity have not changed.

Form GS 1756.010-1 "*Annual Primary Relief Device Capacity Verification*" (see Exhibit A), or an equivalent database or spreadsheet, may be used for documentation.

2.1 Calculating the Capacity of the Pressure Regulation Station

The maximum capacity of each regulator run of the pressure regulation station shall be determined. When more than one pressure regulation run feeds a pipeline, the capacity only needs to be based on complete failure of the largest capacity regulator run.

To calculate the maximum capacity of the regulator run, use the inlet piping system MAOP and the relief device set point.

A lesser capacity than calculated for the pressure regulating run may be used if calculations of flow in the piping on the inlet or outlet of the equipment show a lesser throughput to be the maximum.

2.2 Calculating the Capacity of the Primary Relief Device

Primary relief device capacities shall be determined through calculation and use of manufacturer's literature where applicable.

3. REMEDIATION

If the review determines that the primary relief device has insufficient capacity, Field Engineering shall take prompt action to notify and work with Systems Operations personnel (i.e., M&R, GM&T) to ensure that the relief device has adequate capacity, such as:

a. modifying the existing device (e.g., replace the orifice in the control regulator or relief device),

b. replacing the existing device,

c. installing an additional device,

d. reducing the inlet piping system MAOP and/or MOP, or

e. increasing the relief device set point (if possible).

4. RECORDS

Form GS 1756.010-1 "*Annual Primary Relief Device Capacity Verification*," or equivalent records, indicating the annual verification of the primary relief device capacity and results of subsequent calculations when required for each primary relief device shall be kept for at least five (5) years, plus the current year.

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Gas Standard

Distribution Operations

Effective Date: 01/01/2010	**Annual Review of Primary Relief Devices**	Standard Number: **GS 1756.010**
Supercedes: N/A		Page 4 of 9

EXHIBIT A
(1 of 5)

Instructions for completion of Form GS 1756.010-1,
"Annual Primary Relief Device Capacity Verification."

The following items are keyed to Form GS 1756.010-1, page 5 of this exhibit. Each blank must be completed. If the information to enter on the form is "none" or "not applicable," then insert "N/A" in the appropriate blank.

Key	Item	Description
		HEADING
1	Company	Check appropriate block.
2	Location Number	Use appropriate Operating Location Number (TCC).
3	Operations Map Number	Show Operations Map Number, GIS Grid, and/or transmission Inventory Map Number.
4	Regulator Station Number	Station number will be shown in the blank as shown on transmission inventory maps, distribution operations maps, or on asset accounting records, such as: R-110-D or Reg. No. 4. If two numbers apply, both numbers should be shown.
5	Station Name	List the name by which the station is locally or commonly identified, such as: N. Sugar St., April Alley, Jones Farm, etc.
6	Relief Device Location	Indicate the geographical location of the relief device. Include the nearest road intersection, such as: between Adams and Elm, on Broad.
7	System Number	Indicate the outlet piping system identifier.
8	WMS Premise ID Number	Show number documented in WMS.
9	WMS Function ID Number	Show number documented in WMS.
10	WMS Facility ID Number	Show number documented in WMS.

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Gas Standard

Distribution Operations

Effective Date: 01/01/2010	**Annual Review of Primary Relief Devices**	Standard Number: **GS 1756.010**
Supercedes: N/A		Page 5 of 9

EXHIBIT A
(2 of 5)

Key	Item	Description
		RELIEF DEVICE
11	Manufacturer	List manufacturer name of relief device.
12	Type and Model	List complete type and model description of relief device (e.g., spring – 289H, oil seal, etc.)
13	Size	Indicate size of inlet and outlet connections of relief device, such as 2" x 2", 2" x 3", etc.
14	Orifice Size	Indicate orifice size of relief device. Orifice size may be indicated as a letter designation, area in square inches, or diameter in inches on the nameplate. If no nameplate exists, determine actual orifice size by visual inspection.
15	Spring Range	If color-coded, indicate color and corresponding spring range from manufacturer's literature. If unknown or indeterminable, so note.
16	Set Pressure	Actual set pressure of relief device. NOTE: Confirm that the relief device set pressure has not been changed.
17	Vent Line	Indicate size and length of vent line including valves, elbows, and tees in equivalent length of pipe in feet. Exhibit B can be used to convert to equivalent length.
18	Capacity	Maximum relief device capacity (at set pressure plus build up) as furnished by the manufacturer or ASME badge rating (converted to natural gas).
19	Overpressure at Full Relief Capacity	Calculate and record the maximum build up that would occur in the main at full relief capacity.

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Gas Standard

Distribution Operations

Effective Date: 01/01/2010	**Annual Review of Primary Relief Devices**	Standard Number: **GS 1756.010**
Supercedes: N/A		Page 6 of 9

EXHIBIT A
(3 of 5)

Key	Item	Description
		UPSTREAM SYSTEM AND REGULATION
20	System MOP	Indicate the maximum operating pressure of the upstream system, if known.
21	Manufacturer and Type	Indicate manufacturer and type of control regulator.
22	Reg. Size	Indicate the size of the control regulator.
23	Size of Valves	Indicate the orifice (or valve) size of the regulator.
24	Inlet Max.	Indicate the inlet piping system MAOP to the regulator station.
25	Reg. Maximum Capacity	Capacity shall be calculated, using the “Inlet Max.” and the relief device’s set pressure.
		DOWNSTREAM SYSTEM
26	System MAOP	Self-explanatory
27	Base Load	Unless there are records that can substantiate base load, omit this item by indicating zero load.
28	Max. Allowable Over-Pressure Buildup	The maximum pressure to which the system is allowed to buildup above the MOP as described in GS 1750.040 “Relief Device Inspection and Maintenance.”
29	Required Relief Capacity	To obtain the required relief capacity, the figure obtained in Key 27 is subtracted from Key 25.

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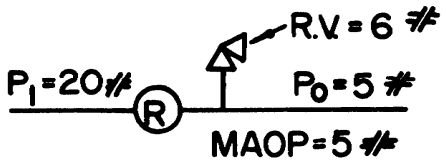
Gas Standard

Distribution Operations

Effective Date: 01/01/2010	**Annual Review of Primary Relief Devices**	Standard Number: **GS 1756.010**
Supercedes: N/A		Page 7 of 9

EXHIBIT A
(4 of 5)

Key	Item	Description
		VERIFICATION OF:
30	Relief Pressure	After comparing overpressure buildup at full relief capacity obtained in Key 19 to pressure determined in Key 28, the appropriate block is checked. If YES, action to provide adequate overpressure protection is required. If NO, no further action is required.
31	Relief Capacity	After comparing capacity obtained in Key 29 to capacity obtained in Key 18, the appropriate block is checked. If YES, no further action is required. If NO, action to provide adequate relief capacity is required.
		MISCELLANEOUS
32	Sketch	Sketch shall reflect: a. a single line sketch of existing facilities, as illustrated below, b. normal inlet and outlet pressure, c. downstream MOP (may equal downstream MAOP), d. maximum allowable overpressure buildup, and e. relief device set pressure.



MOP + Allowable Buildup = 7 ½ psig

33	Verified By	Self-explanatory
34	Date	Self-explanatory

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Gas Standard

Distribution Operations

Effective Date: 01/01/2010	**Annual Review of Primary Relief Devices**	Standard Number: **GS 1756.010**
Supercedes: N/A		Page 8 of 9

EXHIBIT A
(5 of 5)

ANNUAL PRIMARY RELIEF DEVICE CAPACITY VERIFICATION

COMPANY ☐ BSG ☐ CKY ☐ CMD ☐ COH (1) ☐ CPA ☐ CGV ☐ NIPSCO ☐ NIFL ☐ Kokomo Gas			LOCATION NUMBER (2)		OPERATIONS MAP NUMBER (3)
REGULATOR STATION NUMBER (4)		STATION NAME (5)		RELIEF DEVICE LOCATION (6)	
SYSTEM NUMBER (7)	WMS PREMISE ID NUMBER (8)		WMS FUNCTION ID NUMBER (9)		WMS FACILITY ID NUMBER (10)
RELIEF DEVICE	MANUFACTURER (11)		TYPE & MODEL (12)	SIZE (13)	ORIFICE SIZE (14)
	SPRING RANGE (15)	SET PRESSURE (16)		VENT LINE (17)	
	CAPACITY (18)		OVERPRESSURE AT FULL RELIEF CAPACITY (19)		
UPSTREAM SYSTEM AND REGULATION	SYSTEM MOP (20)		MANUFACTURER & TYPE (21)		
	REG. SIZE (22)	SIZE OF VALVES (23)	INLET MAX. (24)	REG. MAXIMUM CAPACITY (25)	
DOWNSTREAM SYSTEM	SYSTEM MAOP (26)	BASE LOAD (27)	MAX. ALLOWABLE OVERPRESSURE BUILDUP (28)		
	REQUIRED RELIEF CAPACITY (29) = MAXIMUM REGULATOR CAPACITY - BASE LOAD				
VERIFICATION OF	RELIEF PRESSURE: (30)	IS OVERPRESSURE AT FULL RELIEF CAPACITY > =	MAXIMUM ALLOWABLE OVERPRESSURE BUILDUP?	☐ YES	☐ NO
	RELIEF CAPACITY: (31)	IS RELIEF DEVICE CAPACITY > =	REQUIRED RELIEF CAPACITY	☐ YES	☐ NO
SKETCH (32)					

VERIFIED BY	DATE	VERIFIED BY	DATE
(33)	(34)		

FORM GS 1756.010-1 (9-09)

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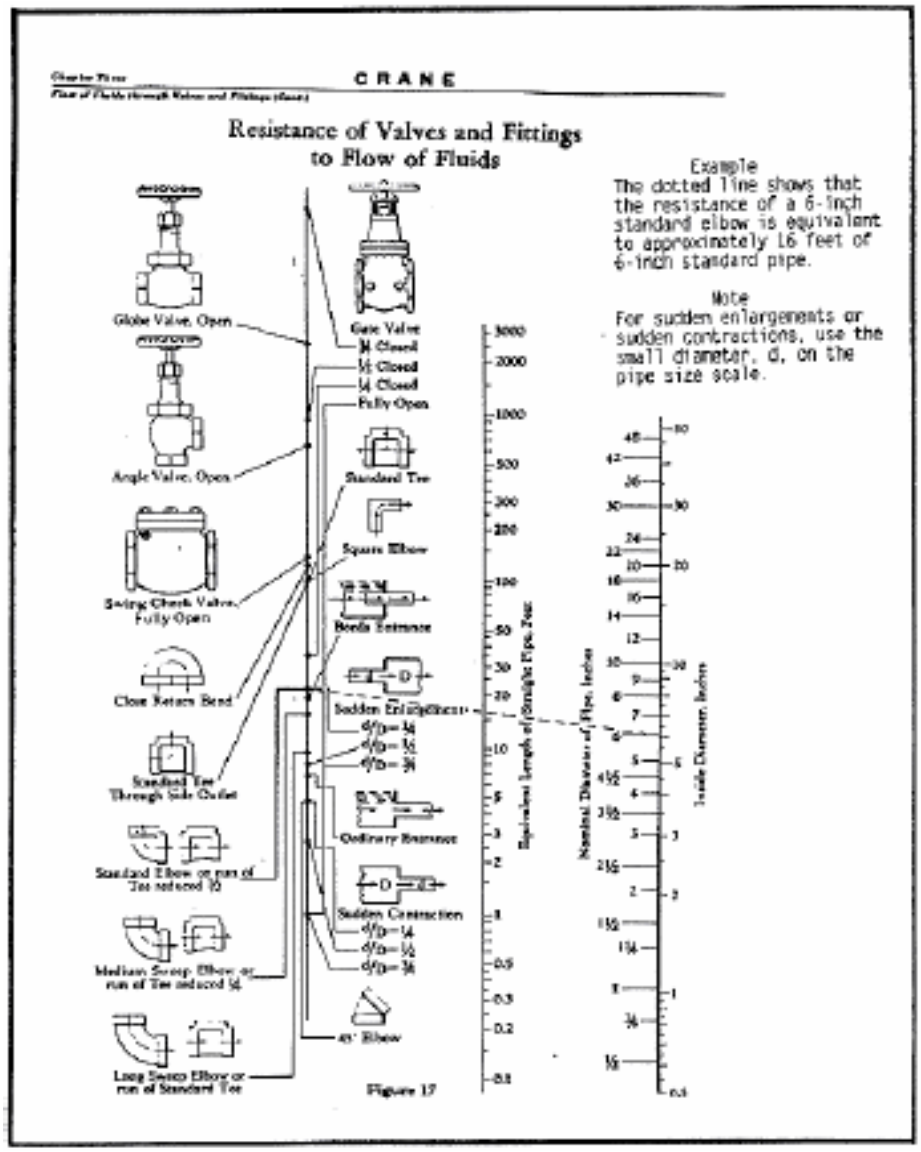
Gas Standard

Distribution Operations

Effective Date: 01/01/2010	**Annual Review of Primary Relief Devices**	Standard Number: **GS 1756.010**
Supercedes: N/A		Page 9 of 9

EXHIBIT B

Determining Equivalent Pipe Length



Example: The dotted line shows that the resistance of a 6-inch standard elbow is equivalent to approximately 16 feet of 6-inch standard pipe.

NOTE: For sudden enlargements or sudden contractions, use the small diameter, d, on the pipe size scale.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2014	**Critical Valve Inspection and Maintenance**	Standard Number: **GS 1760.010(KY)**
Supersedes: N/A		Page 1 of 3

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
	☑ CKY	☐ COH
	☐ CMA	☐ CPA

REFERENCE 49 CFR Part 192.709, 192.745, 192.747; KY 807 KAR 5:006 Section 26(3)

1. GENERAL

Each operating area must maintain a complete, up-to-date set of maps detailing the distribution network. In addition, each operating area must maintain a list of critical valves (also known as emergency valves). A sketch, map, or other means identifying and describing the location of the critical valve and other pertinent information must also be maintained.

Critical valves in distribution systems are valves that are designated by the Company deemed necessary for the safe operation of the system. Each critical valve in a distribution system shall be checked and serviced at least once each calendar year, at intervals not to exceed 15 months.

Critical valves for transmission lines are valves that are designated by the Company that might be required during any emergency. Each critical valve in a transmission line shall be inspected and partially operated at least once each calendar year, at intervals not to exceed 15 months.

2. INSPECTION AND MAINTENANCE REQUIREMENTS

The following requirements shall be followed.

a. Before beginning inspection or maintenance on any critical valve, verify the valve location measurements by reviewing the sketch, map, pertinent information or other means of identifying and describing the location of the critical valve. Inaccurate information should be turned in to the supervisor for maps and/or record corrections.

b. For above ground critical valves, before and after the inspection and maintenance process, ensure that above ground critical valves are locked unless the valves are located within a chain link security fence or a locked building.

c. For below ground critical valves located in unsecured regulator or valve vaults, before and after the inspection and maintenance process, ensure that such below ground critical valves are locked, where practical.

d. For all below ground critical valves, locate the valve box and perform the following.

1. Verify that the valve box lid is identified by the word “GAS.” Lids without the word “GAS” shall be replaced prior to the next annual inspection.
2. Remove the lid and verify if critical valve is tagged with a number. Verify critical valve number associated on the work/job order or related documentation is the same as the critical valve number tagged in the field. If a discrepancy exists, notify supervisor/leader to have the discrepancy corrected. If the critical valve tag is missing, a tag shall be created and installed before the inspection or maintenance task is completed.

e. Check the valve box with a combustible gas indicator. If leakage is indicated, and the valve is a Kerotest Model 1 gate valve, and one can verify that the body to bonnet bolts have been replaced according to the Company’s accepted body to bonnet bolt replacement procedures, then one may continue with the inspection. If leakage is indicated, and the valve is a Kerotest Model 1 gate valve, and one cannot verify that the body to bonnet bolts have been replaced according to the Company’s accepted body to bonnet bolt replacement procedures, do not operate the valve. Report the valve to Supervision for repair. If leakage is found, refer to GS 1714.010, GS 1714.010(KY), GS 1714.010(OH), or GS 1714.010(PA), “Leakage Classification and Response.”

f. If leakage is indicated and one can positively determine that it is not a Kerotest Model 1 gate valve; then continue with the inspection, including operation of the valve.

g. If necessary, the valve box or vault shall be cleared of any debris that would interfere with or delay the operation of the valve.

h. Verify the operating nut is accessible and that the valve key to be used matches the type of operating nut found. The valve location record may contain this information. Observe the valve position so as to leave valve in same position as found when done.

i. Check the valve operation. Valves shall be operated to the extent necessary to establish operability during an emergency. If a valve is to be partially operated, precautions should be taken to avoid a service outage or other abnormal operating conditions. Distribution system critical valves used to separate system pressures or for odorant injection are excluded from being operated.

1. For normally open valves – partially operate towards the closed position but do not close the valve, and return it to its original position.
2. For normally closed valves – partially operate towards the open position but do not open the valve, and return it to its original closed position.

j. For lubricating valves, lubricate a valve only when it is leaking or if it is difficult to turn. Follow manufacturer’s recommendations.

k. Align the valve box to permit the use of a key, wrench, handle or other operating device and adjust it to proper grade.

l. Recheck the valve box with a combustible gas indicator. If leakage is found, refer to GS 1714.010, GS 1714.010(KY), GS 1714.010(OH), or GS 1714.010(PA), "Leakage Classification and Response."

m. Paint the top of the valve box cover yellow, if needed.

n. Complete the inspection record (e.g., work order, job order).

3. REQUIRED REMEDIATION OF INOPERABLE CRITICAL VALVES

If a valve fails to operate satisfactorily, the Company shall take prompt remedial action, for example, repair or replacement, unless the Company designates an alternative valve. Inoperable critical valves must be reported to the supervisor/leader for prompt remedial action. The inoperable condition (including the inability to locate the critical valve) shall be corrected within 15 months of the previous year's inspection or the end of the current calendar year, whichever occurs first, with the following exceptions.

If the inoperable condition cannot be corrected within this time period, Field Operations or Engineering shall have an alternate valve(s) designated to replace its function. A brief "written plan of operation" shall be attached to the inoperable critical valve and the alternative valve records. The alternative valve selected can be another critical valve or an existing non-critical valve.

NOTE: If the alternative valve selected is a non-critical valve, this valve shall meet the requirements of GS 2400.010, GS 2400.010(KY), GS 2400.010(MA), or GS 2400.010(PA), "Critical Valve Design Guidelines" and the requirements of this standard prior to the "written plan of operation" becoming effective. If the valve meets the requirements of this standard then it shall be designated as critical.

Upon correction of the inoperable condition, the "written plan of operation" shall be removed.

If an appropriate alternative valve cannot be designated, the actions taken and the expected timeframe to correct the inoperable condition shall be documented by local leadership and approved by the Operations Center Manager.

4. RECORDS

Complete the Company's critical valve inspection and maintenance record. The date and time of the monitoring or inspection shall be recorded in the electronic WMS Job Order execution remarks field.

Inspection and maintenance records must be kept in the Company's work management system or on file for at least five years plus the current year.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2014	**Curb Box Accessibility/Operability Inspection (CKY)**	Standard Number: **GS 1760.020(KY)**
Supersedes: 10/03/2011		Page 1 of 3

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
	☑ CKY	☐ COH
	☐ CMA	☐ CPA

REFERENCE KY 807 KAR 5:006 Section 23(4)(a)(3), Section 26(3)

1. RESPONSIBILITY

The Operations Center Manager or his designee shall be responsible for the curb box inspection program.

2. DEFINITIONS

For the purpose of this procedure only:

Accessibility is defined as determining that a curb box is visible at or above grade and the curb valve can be accessed after removal of the curb box lid.

Operability is defined as being able to access with a curb key the curb valve.

Designated buildings, are defined as:

a. Any school, hospital, rest or nursing home, shopping center, government building, or recognized day care center;

b. Any building in a business district; and

c. Any building of public assembly that is occupied by 20 or more persons during normal use. Normal use is defined as occupancy on at least 5 days a week for 10 weeks in any 12-month period (days and weeks need not be consecutive).

3. CURB BOX CLASSES

Curb boxes are divided into two classes:

a. Class One which includes all curb boxes:

- where the main is under hard surface,
- where there is no positive shut-off at the main,
- connected to service lines with indoor meters; or
- connected to service lines that serve designated buildings.

b. Class Two curb boxes are those curb boxes that are not classified as Class One.

If the classification of a curb box changes, the curb box shall at the time of the change in classification become subject to the inspection requirements of the revised classification.

4. INSPECTION INTERVALS

4.1 Class One

Class One curb boxes are required to be inspected for accessibility at intervals not exceeding 15 months but at least once each calendar year.

4.2 Class Two

Class Two curb boxes are required to be inspected for accessibility at least every five years not to exceed sixty-three months.

5. CURB BOX RECORDS

The Distributive Information System (DIS) does identify:

a. Whether the service line tee is under pavement (Special Code H).

b. Whether the service line tee is or is not a positive shut-off device. (Identified by the installation date, prior to January 1, 1968, positive shut-off devices were not considered to be installed).

c. Curb box reference measurements.

d. Whether service has an indoor meter.

e. Whether service serves a designated building.

6. CURB VALVE OPERABILITY

Curb valves shall be inspected for operability at the time of the meter change. The inspection shall include removal of the curb box lid, cleaning out as necessary and placement of a curb key on the curb valve.

7. MAINTENANCE

A WMS Job Order shall be issued to correct all deficiencies reported regarding curb box accessibility and curb valve operability. Deficiencies shall be corrected by the end of the 3rd calendar month following reporting. Acceptable methods of correcting deficiencies include repair, replacement or removal of the curb box and/or curb valve.

8. RECORDS

The date and time of the inspection shall be recorded in the electronic WMS Job Order

MiSource
Distribution Operations

Gas Standard

Effective Date: 10/03/2011	**Curb Box Accessibility/Operability Inspection (CKY)**	Standard Number: **GS 1760.020 (KY)**
Supersedes: 07/22/1996		Page 3 of 3

execution remarks field. Where a WMS Job Order does not exist, the date and time shall be documented on form or electronic system used to record the curb box inspection.

MiSource
Distribution Operations

Gas Standard

Effective Date: 09/01/2015	**Maintenance of Vaults and Pits**	Standard Number: **GS 1762.010**
Supersedes: 05/01/2014		Page 1 of 2

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.749 and 192.187

1. GENERAL

This standard applies to **vaults and pits** with a volumetric content of 75 cubic feet or greater.

2. DEFINITIONS

Pit – An underground structure with full-opening doors for entry.

Vault – An underground structure accessed through a limited means of access such as a manhole.

3. INSPECTION

Vaults and pits with a volumetric content of 75 cubic feet or greater shall be inspected at least once each calendar year not to exceed 15 months. The following actions shall be taken when inspecting the vault.

a. Check that the vault or pit is in good physical condition.

b. Associated ventilation equipment shall be inspected to ensure it is functioning properly such as vent lines are properly connected, free of any obstruction, and properly vented to a safe location above ground outside the structure with their outlets extending high enough above grade to disperse any gas-air mixture that may be discharged.

c. Check for the presence of gas with a leak detection instrument. If gas is found in the vault or pit all equipment and pipe shall be inspected for leaks. If no leaks are found in the vault or pit, then the leak investigation shall be extended to facilities outside the vault or pit. Any leaks found shall be classified according to GS 1714.010(XX) “Leakage Classification and Response.” All leaks inside the vault or pit shall be classified according to GS 1714.010(XX) “Leakage Classification and Response.” All leaks inside the vault or pit shall not be classified as a Grade 3 leak. Appropriate paperwork shall be completed.

d. Check the vault or closed top pit cover to assure it does not present a hazard to public safety.

3.1 Vaults and Pits installed after November 19, 1970

Check for adequate vault ventilation for vaults and pits installed after November 19, 1970. Two ventilation ducts are required for vaults or closed top pits having a volumetric content of 200 cubic feet or greater, each having at least the ventilation effect of a pipe four (4) inches in diameter. Any horizontal sections should be as short as possible and pitched to prevent accumulation of liquids. The number of bends and offsets should be kept at a minimum with provisions to facilitate periodic cleaning. When two ducts are used, one vent opening should be higher than the other to promote ventilation. Vaults or closed top pits with a volumetric content less than 200 cubic feet but greater than 75 cubic feet must be either:

a. Vented with an means of preventing external sources of ignition from reaching the vault atmosphere, or

b. Sealed with tight fitting covers over each opening without holes and a means to test the internal vault or pit atmosphere before removing the cover, or

c. Ventilated with ducts or have openings in the cover or grating that yields a ratio or internal volume to effective venting area to less than 20 to 1.

4. REMEDIATION OF VAULTS AND PITS

Deficiencies shall be corrected promptly and in all cases must be corrected prior to the next scheduled annual inspection.

5. RESPONSILITY

System Operations shall be responsible for inspecting the vaults and pits and initiating corrective action to correct any deficiencies noted.

6. RECORDS

Associated records will be maintained within the Company's work management system or other applicable records.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Prevention of Accidental Ignition**	Standard Number: **GS 1770.010**
Supersedes: 01/01/2014		Page 1 of 3

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.751

1. GENERAL

All applicable Company safety procedures shall be followed prior to entering any structure or area, including vaults, pits, manholes, and excavations, to protect personnel from the hazards of unsafe accumulations of vapor or gas. For information to better define potential hazardous conditions refer to HSE 4100.010 “Hazardous Atmosphere Considerations.”

Ensure any piping has been depressurized prior to cutting or separating.

Post warning signs where appropriate.

2. SMOKING AND OPEN FLAMES

Smoking and open flames are prohibited in the following locations:

a. in structures or areas containing gas facilities where possible leakage or presence of gas constitutes a hazard of fire or explosion,

b. in the open when accidental ignition of gas-air mixture might cause personal injury or property damage, and

c. in any area with such warning signs currently posted.

“No Smoking or Open Flames” warning signs shall be posted at buildings, other above ground enclosures, and fences that contain pressure regulating stations (e.g., gate/town border stations, district stations).

3. ACCIDENTAL IGNITION OF HAZARDOUS ATMOSPHERES

To prevent accidental ignition of hazardous atmospheres, the following requirements apply.

3.1 Electric Equipment

Employees shall not enter a potentially hazardous atmosphere with non-intrinsically safe equipment such as cell phones, pagers, handheld lighting, heating irons, power tools, motorized facers, or similar devices. Employees must either turn those devices off prior to entering a potentially hazardous area or leave those devices in a safe

location.

Employees shall use only those devices and equipment that have been approved by the Company. Employees shall evaluate what equipment is needed prior to entering an area and take only those devices and equipment that are critical to the activity.

Care shall be taken to ensure that electrical connections and disconnections are not made, and are prevented from occurring, in hazardous atmospheres.

3.2 Motorized Equipment

All motorized equipment shall be parked at a safe distance upwind from the work area where unsafe accumulations of vapor or gas do not exist. Only those engines/equipment that are necessary for the completion of the project, and that present no potential danger, shall be running upwind of the work location. Workers shall be aware of changing wind and other conditions that may require the shutting down or movement of operating equipment.

3.3 Static Electricity on Plastic Pipe

In plastic pipe operations, the Company shall reduce the accumulation of a flammable gas-air mixture to a safe level and reduce the potential arcing of a static electrical discharge prior to performing any activities on the system.

Prior to cutting or squeezing-off plastic pipe, the employee shall take action to remove and/or prevent the buildup of static electrical charges, such as wiping the pipe with a wet burlap/cotton cloth or wrapping the pipe with wet soapy burlap/cotton rags or applying other approved static reducing materials. Cutting and squeeze-off tools shall be grounded by attaching a wire from the tool to a metallic device driven into the ground.

4. GAS OR ELECTRIC WELDING OR CUTTING

Gas or electric welding or cutting shall not be performed on pipe or on pipe components that contain a combustible mixture of gas and air in the area of work.

The work area shall be continually monitored near the welding or cutting with a combustible gas indicator whenever a hazardous atmosphere could reasonably be expected.

5. VENTING

When any gas is being vented into open air, each potential source of ignition must be removed from the area and a fire extinguisher must be provided. Vent pipes shall be placed away from sources of ignition; i.e., they shall not be placed directly under electrical transformers and overhead wires.

Plastic pipe shall not be used as vent pipe due to the possibility that venting gas could

generate an internal static electrical charge that could ignite the escaping gas. Metal vent pipe shall be grounded before venting.

6. TEMPORARY BONDING – METALLIC PIPELINES

Whenever a metallic pipeline is to be separated, regardless of the method, temporary bonding clamps shall be installed across the separation to allow a path for stray electrical current to follow. Magnetic bonding clamps shall not be used because they do not provide a reliable means of electrical continuity. Where gas is present, bonding clamps shall be installed before joining two sections of metallic pipe together, such as making a tie-in.

Bonding clamps shall be installed in such a manner as to ensure that they do not become detached during construction and that they provide minimal electrical resistance between pipe sections.A #8 AWG copper flexible wire is the minimum size bonding wire to be used for bonding mains and/or service lines. A #2 AWG flexible wire is the minimum size wire to be used when bonding in stray current areas. Refer to GS 1420.120 “Controlling AC Interference” for safety precautions when working in the vicinity of high voltage power lines.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2013	**Cast Iron - General**	Standard Number: **GS 1780.010**
Supersedes: 04/01/2009		Page 1 of 4

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.753

1. GENERAL

Cast iron, ductile iron, and gray iron are terms used to describe the family of materials to which this gas standard applies. Ductile iron and gray iron have the general characteristics and the same joining techniques as cast iron. When the term “cast iron” is used in this gas standard, it also refers to ductile iron and gray iron.

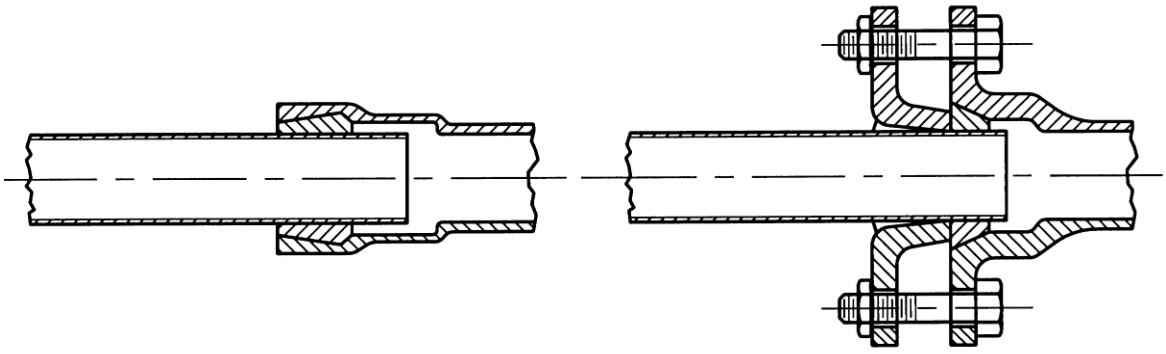
Cast iron, ductile iron, or gray iron is susceptible to graphitic corrosion, which is commonly termed as “**graphitization**,” when buried in wet soils containing sulfates. The graphite in gray cast iron is cathodic to iron and remains behind as porous mass when iron is slowly leached out. Malleable iron and wrought iron are from different families of materials and have characteristics closer to steel materials than does the cast iron family. Graphitization does not occur in malleable iron or wrought iron.

The use or reuse of cast iron as either new or replacement pipe is prohibited. Any cast iron pipe requiring replacement shall be replaced with coated steel or plastic pipe.

2. BELL AND SPIGOT JOINTS

Bell and spigot joints are formed by caulking the space between the bell and spigot with a material which will make a gas tight joint, such as cast lead, lead wool, cement, and rubber rings. In all cases, along with the principal material, a packing or “yarn” is used, and in some instances composite joints are made by using two different materials in successive layers.

The figure below depicts a typical bell and spigot joint, as well as a typical mechanical bell joint.



BELL & SPIGOT JOINT

MECHANICAL BELL JOINT

3. MAXIMUM ALLOWABLE OPERATING PRESSURE (MAOP) OF CAST IRON

Each cast iron caulked bell and spigot joint that is subject to pressures more than 25 psig must be sealed with:

1. a mechanical clamp, or
2. a material or device that meets all of the following requirements.
   a. It does not reduce the flexibility of the joint.
   b. It permanently bonds, either chemically or mechanically, or both, with the bell and spigot metal surfaces or adjacent pipe metal surfaces.
   c. It seals and bonds in a manner that meets the strength, environmental, and chemical compatibility requirements for materials in gas service.

Cast iron mains, in which there are un-reinforced bell and spigot joints, shall not be operated at a pressure that exceeds 25 psig.

Cast iron mains with reinforced joints shall not be operated over 25 psig unless authorized by Engineering management. In addition to the mechanical bell joint depicted in the figure above, see Section 4 for acceptable methods of sealing/reinforcement.

4. CAST IRON MAINTENANCE

Each cast iron caulked bell and spigot joint that is subject to pressures of 25 psig or less and is exposed for any reason must be sealed by a means other than caulking. Acceptable sealing/reinforcement methods are described below:

a. mechanical bell joint clamps,
b. encapsulation, or

c. anaerobic sealants.

Bell and spigot joints sealed by an anaerobic sealant, encapsulation, and/or mechanical bell joint clamps are limited by the manufacturer's maximum pressure ratings. Sealing methods shall be done in accordance with manufacturer's instructions.

When replacing the bolts on a mechanical bell joint, malleable iron bolts and nuts shall be used as replacements; steel bolts and nuts are prohibited. If malleable iron bolts and nuts cannot be found, consider another sealing method or replacement.

When replacing the bolts on a mechanical bell joint clamp, consult manufacturer's specifications for replacement bolts.

4.1 Repair

Refer to applicable gas standards for guidance on the permanent repair of cast iron pipe.

NOTE: When a temporary repair method is used on cracks or leaks in cast iron, the leak should be monitored on a daily basis until a permanent repair or replacement is made.

4.2 Support and Backfilling

When routine maintenance, such as bell joint clamping or replacement of service connections, occurs on cast iron pipe, care shall be taken to bed the pipe properly to prevent pipe settlement. If the bottom of the cast iron pipe has been exposed, precautions shall be taken when backfilling to assure that the pipe rests upon a well compacted base that is as free of voids as possible. A flowable (controlled density) backfill, such as "K Krete" or "Flash Fil," may be used. Care must be taken to prevent damage to the pipe from equipment or from the backfill material.

5. GRAPHITIZATION

Graphitization may be difficult to detect visually. In order to conduct an adequate visual examination, the pipe surface must be thoroughly cleaned. Rasping and wire brushing the surface to remove scales may reveal graphitization areas as "gray" colored patches. Also, the pipe will show depressions or craters where the softer material has been removed. A physical inspection will reveal that the graphitized surface areas are softer than the non-corroded surface areas. This may be determined by probing with a pointed object. The gray graphitized areas will also "powder" when scraped.

When graphitization is suspected, it is necessary to determine the remaining wall thickness. Either a sonic thickness tester or calipers (to measure a coupon's thickness can be used). It is also necessary to determine the extent of graphitization by exposing additional pipe.

NOTE: Cast iron pipe in the advanced stage of graphitization may be able to withstand

considerable gas pressure so long as it is not disturbed. However, because of its decreased wall strength, the pipe is subject to cracking or other sudden failure in graphitized areas if vibrations, ground settlement, bending, or other forces are applied. Therefore, field personnel should be aware of the potential for a sudden rupture when examining and making repairs on cast iron pipe.

5.1 Remedial Measures

Localized graphitization occurs as a penetrating attack confined to a few small locations (pitting). Each segment of cast-iron pipe on which localized graphitization is found to a degree where leakage exists or might result shall be replaced or repaired with an appropriate repair device. Refer to applicable gas standards for guidance on the repair of cast iron pipe.

General graphitization occurs as a pipe wall loss over a large area. Each segment of cast-iron pipe on which general graphitization is found to a degree where a fracture or leakage exists or might result shall be replaced. In addition, replacement of graphitized pipe shall be considered when the condition is found adjacent to buildings, sewers, manholes, cable ducts, or areas subject to heavy traffic, or when the pipe is situated in unstable soil.

Both types of graphitization can occur on any segment of cast iron pipe. Refer to GS 1782.010 “Protecting Cast Iron Pipelines” for replacement guidance.

6. SURVEILLANCE AND/OR SUPPLEMENTAL LEAKAGE SURVEYS

Surveillance and/or leakage surveys shall be considered on any portion of cast iron piping during and after excavating or other activity that would create stress on the piping. Particular attention shall be given, both during and after excavation, to the possibility of leaking joints and breaks.

During periods of extreme cold weather that causes soil freezing (frost) to cast iron main depths, consideration shall be given to performing precautionary leakage surveys during the freeze and thaw periods.

Refer to applicable gas standards for more guidance on supplemental and winter leakage surveys.

7. RECORDS

Documentation of the type of reinforcement, as well as the authorization from Engineering management to operate cast iron with reinforced bell and spigot joints at a pressure above 25 psig, shall be filed with the appropriate MAOP record(s).

The method used to seal each cast iron caulked bell and spigot joint that is subject to pressures of 25 psig or less that is exposed for any reason shall be documented in the Company’s work management system, or equivalent.

MiSource
Distribution Operations

Gas Standard

Effective Date: 04/01/2009	**Protecting Cast Iron Pipelines**	Standard Number: **GS 1782.010**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE 49 CFR Part 192.755, 192.317(a), 192.319, 192.361(b),(c),(d)

1. GENERAL

When the Company has knowledge that the support for a segment of a buried cast iron pipeline is disturbed or will be disturbed, it shall be properly protected, supported, or replaced. Consult with local Engineering for assistance to determine the appropriate protection method. Refer to GS 1780.010 “Cast Iron - General” for additional guidelines.

2. CAST IRON PROTECTION

The Company shall promptly take appropriate steps to provide permanent protection from damage that might result from external loads for a disturbed cast iron segment. External loads on the cast iron include:

a. vibrations from heavy construction equipment, trains, trucks, buses, major demolition projects, or blasting;

b. impact forces by vehicles;

c. earth movement resulting from washouts, floods, unstable soil, landslides, freeze-thaw cycles, or other hazards that may cause the pipeline to move or to sustain abnormal loads (e.g., water leaks, sewer failures, earthquakes);

d. existing or apparent future excavations/encroachments near the pipeline; or

e. other foreseeable outside forces which may subject that segment of the pipeline to bending stress.

Steps may include dewatering the excavation, providing temporary or permanent shoring or sheeting, supporting the pipeline by use of bridging or bracing, or compacting the soil surrounding the cast iron pipeline with a suitable backfill.

The affected cast iron pipeline should be considered for replacement after reviewing its maintenance and leak history, along with the current circumstances. Consider supplemental surveys or surveillance until the pipeline is replaced, while excavation activities are ongoing, or until replacement is determined to be unnecessary.

NOTE: The ability for cast iron pipe to withstand external loading decreases with smaller pipe size.

See Section 4 for replacement guidelines.

3. SUPPORT AND BACKFILLING

When a trench, bell-hole, or other excavation occurs on cast iron pipe, care shall be taken to bed the pipe properly to prevent pipe settlement. If the bottom of the cast iron pipe has been exposed, precautions shall be taken when backfilling to assure that the pipe rests upon a well compacted base that is as free of voids as possible. A flowable (controlled density) backfill, such as “K Krete” or “Flash Fil,” may be used. Care must be taken to prevent damage to the pipe from equipment or from the backfill material.

4. REPLACEMENT OF CAST IRON

Where replacement of the cast iron pipe is deemed necessary, the length of the replacement segment shall be such that all cast iron is removed from within the angle of repose for the particular soil involved (normally assumed to be 45^0). Where the replacement crosses an excavation, the replacement section should be centered so as to extend an approximately equal distance on each side of the excavation. See Figure 1.

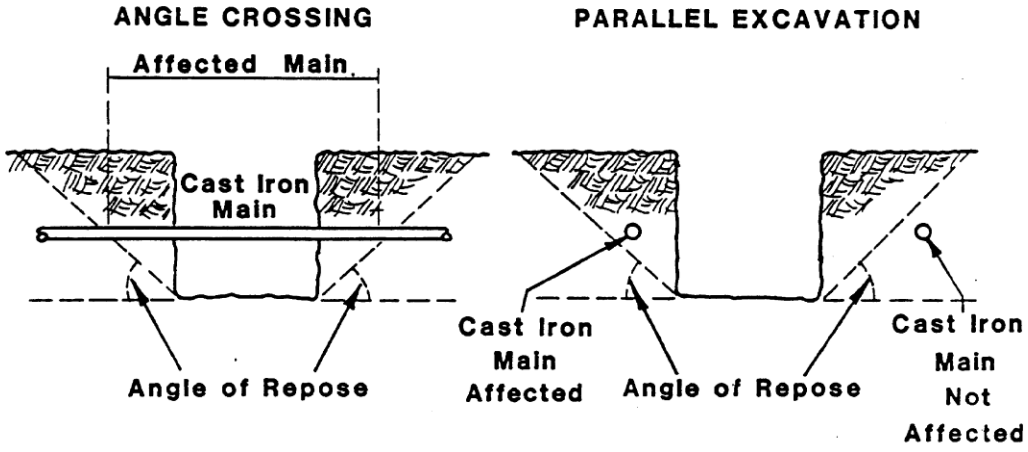


Figure 1

If the excavation is adequately protected by structural shoring (sheeting) against movement of the cast iron main and the excavation fill is well tamped, the main may not need to be replaced.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2014	**Design - General**	Standard Number: **GS 2100.010**
Supersedes: N/A		Page 1 of 27

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE 49 CFR - Part 192 - Subpart C and §192.143

1. GENERAL INFORMATION

This procedure provides basic design data to analyze and resolve field design problems.

Where state or local governmental requirements may take precedence, the more stringent requirement shall apply.

Components of steel and plastic piping systems, such as valves, fittings, regulators, etc., shall be carefully selected to withstand without impairment the anticipated MAOP and secondary stresses. If unit stress comparison is impractical, established manufacturer's rating established by testing may be used in determining the components' suitability for service.

2. DESIGN INFORMATION

2.1 Design Class Location

To avoid maintaining class location records and conducting periodic class location reviews, consideration should be given to designing distribution owned piping for a Class 4 location as defined by GS 1640.010 “Class Location Determination for Transmission Lines” and GS 2110.020 “Steel Pipe Design.”

Request for exceptions to a Class 4 location design and/or a main to operate above 20% of Specified Minimum Yield Strength (SMYS) will be addressed to Manager, Engineering. GS 2110.020 “Steel Pipe Design” and GS 2400.020 “Transmission Line Valve Design Requirements” provides design guidance and GS 1640.020 “Annual Class Location Verification,” GS 1704.010 or GS 1704.010(KY) “Patrolling Transmission Lines,” GS 1708.020 or GS 1708.020(KY) or GS 1708.020(MD) or GS 1708.020(PA) “Leakage Surveys,” and GS 1720.010 “Line Markers for Mains and Transmission Lines” and provide operating guidance for such lines.

2.2 Steel Pipe Design

The design pressure for various steel piping system materials shall be in conformance with GS 2110.020 “Steel Pipe Design.”

When it is necessary to join pipeline materials of different SMYS, the system shall be designed so that the thickness of the low yield material does not exceed 1.5 x the thickness of the higher yield material. (See applicable welding procedures for welding guidance.) If pipes of different wall thicknesses are to be joined, the thicker pipe shall have its end taper-bored to be within the acceptable wall thickness mismatch, in accordance with applicable welding procedures.

When designing steel piping distribution systems, where the gas received from suppliers, local producers, etc. does not meet Company quality specifications, the Field Engineer shall consider designing for internal corrosion control. (Refer to GS 2910.010, "Gas Supply - Gas Quality Specifications.") However, when designing distribution owned transmission lines, the Gas System Design Engineer shall refer to GS 1420.110, “Internal Corrosion Design Guidelines for Transmission Lines.”

2.2.1 Wall Thickness

The preferred minimum and absolute minimum wall thickness specification for buried steel pipelines for each nominal pipe diameter are contained in Table 1.

Table 1

Nominal Diameter (in)	NiSource Preferred Minimum Wall Thickness (in)	NiSource Minimum Wall Thickness (in)	Nominal Diameter (in)	NiSource Preferred Minimum Wall Thickness (in)	NiSource Minimum Wall Thickness (in)
1 ¼	0.191	0.133	12	0.250	0.203
2	0.154	0.154	16	0.312	0.219
3	0.216	0.156	20	0.312	0.237
4	0.237	0.156	24	0.375	0.250
6	0.250	0.156	30	0.375	0.281
8	0.250	0.172	36	0.375	0.312
10	0.250	0.188			

2.3 Plastic Pipe Design

2.3.1 Pressure Limitations

Thermoplastic pipe (such as polyethylene) routinely purchased for gas distribution main and services is limited to a MAOP of 60 psig for PE 2406/2708 (medium density) and 99 psig for PE 3408/4710 (high density).

Plastic pipe may be considered for applications where the MAOP of a piping system is greater than 99 psig as long as the following conditions are met.

a. Pipe was manufactured after July 14, 2004.

b. The design pressure does not exceed 125 psig.

c. The material is a PE2406/2708 or a PE3408/4710 as specified within ASTM D2513-99.

d. The pipe size is nominal pipe size (IPS) 12 or less.

e. The design pressure is determined in accordance with the design equation defined in the next section of this standard.

Polyamide-11 (PA-11) plastic pipe may be used for pressures exceeding 125 psig as long as the following conditions are met.

a. PA-11 pipe was manufactured after January 23, 2009.

b. The design pressure does not exceed 200 psig.

c. The pipe size is nominal pipe size (IPS or CTS) 4-inch or less.

d. The pipe has a standard dimension ratio of SDR-11 or greater (i.e., thicker pipe wall).

Note: PA-11 fittings can only be used on PA-11 pipe.

Approval of the Engineering Manager shall be obtained prior to installation of plastic pipe to be operated at or above 100 psig.

2.3.2 Design Pressure

The design pressure of plastic pipe shall be in conformance with Part 192, Section 192.121 according to the formula:

$$P = 2S\frac{t}{(D-t)}0.32 \qquad \text{or} \qquad P = \frac{2S}{(SDR-1)}0.32$$

where: P = Design pressure [psig]

S = Hydrostatic Design Basis (HDB) for a specific temperature (from PPI Technical Reports TR-3/2004 Part D.2 and TR-4 (latest version))

t = Specified wall thickness [in.]

D = Specified outside diameter [in.]

SDR = Standard dimension ratio

2.3.3 Temperature Limitations

The maximum temperature that plastic pipe can operate at depends on the plastic pipe HDB. As temperature of the plastic pipe increases, the design pressure decreases. Consult the manufacturer's literature for the HDB of the pipe being used. Other plastic materials have different HDB's and maximum temperatures. Contact Gas Standards for this information.

Polyethylene piping shall not be installed below ground where the operating temperature of the material will be below -20ºF or above the temperature limitation of the HDB used in the design formula above (thermosetting plastic: -20ºF or above 150ºF).

2.3.4 Aboveground Applications

Permanent installation above ground, cased or uncased, is not permitted, except where approved meter service risers are installed or installed on bridge crossings (see GS 2200.020(CG) "Above Ground Bridge Crossings"). The minimum temperature shall not be below -20 ºF.

Temporary installation of uncased plastic pipe aboveground is permitted as detailed in GS 3010.060 "Installation of Plastic Pipe."

2.3.5 Below Ground Enclosure

Exposure of plastic pipe in a below ground enclosure, such as manholes, sewers, etc., is not permitted. Refer to GS 3010.060 "Installation of Plastic Pipe."

3. SYSTEM DESIGN PRESSURE

A best practice is to design additions or replacements to the system so that the minimum main pressure does not fall below 25% MAOP. For growth areas, the minimum main pressure should not fall below 50% MAOP.

For the purpose of standardizing system design pressure, the following guidelines have been established:

Type of System	Min. Main Press	Max. Reg. Outlet Press.	Main Press. Drop Guidelines/1000'	Service Line[7] Press. Drop
LP	7" WC[2]	14" WC[5]	0.75" WC	0.5" WC
IP[1]	1 psig	10 psig	16" WC	16.0" WC
MP	2 psig[3]	60 psig	2 psig	16.0" WC
HP	60 psig[4]	Per Design[6]	1 psig	2 psig

NOTES:

1. Not applicable to IP Systems existing prior to January 1, 1977, unless upgraded. The pressure range limit for those systems is 1 to 5 psig. Service line inserts with 1/2" CTS (5/8" O.D.) plastic tubing are limited to systems with a 2 psig minimum.

2. 7" W.C. is recognized to be the pressure at the main.

3. 15 psig minimum inlet is to be maintained on the inlet to the District regulator supplied by a M.P. System.

4. 60 psig minimum inlet is to be maintained on the inlet of a District regulator supplying a M.P. system from a H.P. system.

5. The preferred operating pressure at the outlet of the District regulator serving a L.P. system is 12" W.C. L.P. systems can be operated outside of the preferred range when warranted, especially during peak flow periods or for other operational needs. Any L.P. system that must operate at 14" W.C. or greater during peak periods to meet minimum pressure requirements shall be reported to Engineering. Engineering shall evaluate the system for actions (e.g. orifice changes, system improvements) that would be necessary to permit operating the system at or below 14" w.c. at design (peak-day) conditions.

6. 125 psig is the next normally accepted design pressure.

7. Refer to GS 2120.020 "Service Line Sizing."

4. LOAD STUDY DETERMINATION

Work Orders involving betterment, mandatory relocation, and new business should be referenced to network studies, whenever possible. The purpose is to insure that the above design guidelines have been considered and proper pipe size is utilized.

Network Analysis studies should be completed on all systems and reviewed or updated every five years.

5. CONSUMPTION FACTORS

The following factors for residential and commercial accounts have been developed and proven satisfactory for use in converting consumption's to approximate load conditions values where more definitive information is not available:

Day to hour	- 0.05	Month to hour	- 0.003
Month to day	- 0.06	Annual to peak month	- 0.17

The Industrial Representative should be consulted when converting industrial consumption's.

The Operations Engineer, when sizing a feed line into an undeveloped residential area, should consider the total acreage (1 square mile = 640 acres) to be served by the line. A factor of 0.67 acre per lot, which allows for playgrounds, streets, rights-of-ways, and reserved ground, can be applied against the total acreage to determine the number of residential lots. The number of lots is converted to load as explained in the following paragraph. It does not allow for commercial or industrial loads, which might be added.

Exhibits A to G provides design data to establish the consumption or loading for mobile home parks and residential subdivisions. The figures are conservative. The Operations Engineer must make a judgment as to which Exhibit to use based on the size of home, insulation and furnace type.

6. FUEL CONVERSION FACTORS

Typical thermal conversion factors for competitive fuels are provided as follows:

Fuel	BTU (Gross)*
Electrical energy	3,412/KW-Hr
Distillate fuel oils (Grades 1-4)	5,825M/bbl or 140,000/gal.
Bituminous coal and lignite	26,200M/Ton or 13,100/lb.
Anthracite	25,400M/Ton or 12,700/lb.
Propane	91,500/gal.
Natural gas	1,020/cu. ft.

* Based on a 42 gallon barrel or 2,000 pound ton as appropriate.

7. FLOW FORMULAS

Basic formulas used for distribution flow, or pressure drop determination are:

Flow Formula	Pressure System	Name of Available Digital Computer Program	Available Sliderules
Spitzglass	L.P.	Network Analysis III	CGS Flow Sliderule
Spitzglass	I.P., M.P.	Line Section, Network Analysis III, ISAP	CGS Flow Sliderule
IGT	I.P., M.P., H.P.	Line Section, Network Analysis III, ISAP	None
Weymouth	H.P.	Line Section, ISAP	Davis Pipeline (Flow) Sliderule
Panhandle A or B	H.P.	Line Section, ISAP	None
AGA-IGT (Partially turbulent)	H.P.	Line Section, ISAP	None
Plexco - Mueller	All Plastic Pipe	Line Section	None

Notes: "Line Section" refers to a separate computer program developed by Columbia Gas System Operations Research Department under their inter-active System Design Package and addresses the problem of calculating pressure drop in various size pipe sections for varying flow rates utilizing six different flow formulas.

"ISAP" refers to Integrated System Analysis Program which is utilized to perform transmission type piping system analysis. This program is utilized in distribution on D-Lines and H.P. Belt Systems.

Network Analysis III is a distribution Network Analysis Program which utilizes three separate flow formulas depending upon the type of system being analyzed.

Exhibit H provides flow information that can be used as a field guide in main sizing.

Exhibit I presents the Spitzglass, Weymouth, IGT and Panhandle (A or B) Formulae.

Exhibit J presents table of squares of the absolute pressures which are used in conjunction with the Davis Pipeline (Flow) Sliderule.

EXHIBIT A

PIPELINE DESIGN CAPACITIES FOR
Mobile Home Parks
(All Volumes in Cu. Ft. per Hr.)

Number of Customers	Heat Load	X	Diversity Factor	=	Total Heat Load	+	Base Load	=	Total Load
1	32		1.000		32		8		40.0
2	64		.975		62.4		16		78.4
3	96		.955		91.7		24		115.7
4	128		.937		119.9		32		151.9
5	160		.920		147.2		40		187.2
6	192		.910		174.7		48		222.7
7	224		.898		201.2		56		257.2
8	256		.886		226.8		64		290.8
9	288		.877		252.6		72		324.6
10	320		.868		277.8		80		357.8
11	352		.859		302.4		88		390.4
12	384		.852		327.2		96		423.2
13	416		.845		351.5		104		455.5
14	448		.838		357.4		112		487.4
15	480		.832		399.4		120		519.4
16	512		.827		423.4		128		551.4
17	544		.823		447.7		136		583.7
18	576		.818		471.2		144		615.2
19	608		.815		495.5		152		647.5
20	640		.812		519.7		160		679.7
21	672		.809		543.6		168		711.6
22	704		.807		568.1		176		744.1
23	736		.804		591.7		184		775.7
24	768		.802		615.9		192		807.9
25	800		.800		640.0		200		840.0
26	832		.799		664.8		208		872.8
27	864		.798		689.5		216		905.5
28	896		.797		714.1		224		938.1
29	928		.796		738.7		232		970.7
30	960		.795		763.2		240		1003.2
35	1120		.793		888.2		280		1168.2
40	1280		.790		1011.2		320		1331.2
45	1440		.787		1133.3		360		1493.3
50	1600		.784		1254.4		400		1654.4
55	1760		.782		1376.3		440		1816.3
60	1920		.780		1497.6		480		1977.6
65	2080		.779		1620.3		520		2140.3
70	2240		.777		1740.5		560		2300.5
75	2400		.776		1862.4		600		2462.4
80	2560		.774		1981.4		640		2621.4
85	2720		.773		2103		680		2783
90	2880		.771		2221		720		2941
95	3040		.771		2344		760		3104
100	3200		.770		2464		800		3264
110	3520		.768		2703		880		3583
120	3840		.766		2941		960		3901
130	4160		.764		3178		1040		4218
140	4480		.762		3414		1120		4534
150	4800		.760		3648		1200		4848
160	5120		.758		3881		1280		5161
170	5440		.756		4113		1360		5473
180	5760		.754		4343		1440		5783
190	6080		.752		4572		1520		6092
200	6400		.750		4800		1600		6400

EXHIBIT B

PIPELINE DESIGN CAPACITIES FOR RESIDENTIAL SUBDIVISION
1575 ft² Homes (New Style – 75% Eff. Furnace with R-19 Insulation)
(All Volumes in Cu. Ft. per Hr.)

Number of Customers	Heat Load	X	Diversity Factor	=	Total Heat Load	+	Base Load	=	Total Load
1	55		1.000		55		12		67
2	110		.975		107		24		131
3	165		.955		158		36		194
4	220		.937		206		48		254
5	275		.920		253		60		313
6	330		.910		300		72		372
7	385		.898		346		84		430
8	440		.886		390		96		486
9	495		.877		434		108		542
10	550		.868		477		120		597
11	605		.859		520		132		652
12	660		.852		562		144		706
13	715		.845		604		156		760
14	770		.838		645		168		813
15	825		.832		686		180		866
16	880		.827		728		192		920
17	935		.823		770		204		974
18	990		.818		810		216		1026
19	1045		.815		852		228		1080
20	1100		.812		893		240		1133
21	1155		.809		934		252		1186
22	1210		.807		977		264		1241
23	1265		.804		1017		276		1293
24	1320		.802		1059		288		1347
25	1375		.800		1100		300		1400
26	1430		.799		1143		312		1455
27	1485		.798		1185		324		1509
28	1540		.797		1227		336		1563
29	1595		.796		1270		348		1618
30	1650		.795		1312		360		1672
35	1925		.793		1527		420		1947
40	2200		.790		1738		480		2218
45	2475		.787		1948		540		2488
50	2750		.784		2156		600		2756
55	3025		.782		2366		660		3026
60	3300		.780		2574		720		3294
65	3575		.779		2785		780		3565
70	3850		.777		2992		840		3832
75	4125		.776		3201		900		4101
80	4400		.774		3406		960		4366
85	4675		.773		3614		1020		4634
90	4950		.771		3817		1080		4897
95	5225		.771		4029		1140		5169
100	5500		.770		4235		1200		5435
110	6050		.768		4646		1320		5966
120	6600		.766		5056		1440		6496
130	7150		.764		5463		1560		7023
140	7700		.762		5867		1680		7547
150	8250		.760		6270		1800		8070
160	8800		.758		6670		1920		8590
170	9350		.756		7069		2040		9109
180	9900		.754		7465		2160		9625
190	10450		.752		7858		2280		10138
200	11000		.750		8250		2400		10650

EXHIBIT C

PIPELINE DESIGN CAPACITIES FOR RESIDENTIAL SUBDIVISIONS
1575 ft^2 Homes (Old Style – 65% Eff. Furnace with R-19 Insulation
(All Volumes in Cu. Ft. per Hr.)

Number of Customers	Heat Load	X	Diversity Factor	=	Total Heat Load	+	Base Load	=	Total Load
1	63		1.000		63		12		75
2	126		.975		123		24		147
3	189		.955		181		36		217
4	252		.937		236		48		284
5	315		.920		290		60		350
6	378		.910		344		72		416
7	441		.898		396		84		480
8	504		.886		447		96		543
9	567		.877		497		108		605
10	630		.868		547		120		667
11	693		.859		595		132		727
12	756		.852		544		144		788
13	819		.845		692		156		848
14	882		.838		739		168		907
15	945		.832		786		180		966
16	1008		.827		834		192		1026
17	1071		.823		881		204		1085
18	1134		.818		928		216		1144
19	1197		.815		976		228		1204
20	1260		.812		1023		240		1263
21	1323		.809		1074		252		1326
22	1386		.807		1119		264		1383
23	1449		.804		1165		276		1441
24	1512		.802		1213		288		1501
25	1575		.800		1260		300		1560
26	1638		.799		1309		312		1621
27	1701		.798		1357		324		1681
28	1764		.797		1406		336		1742
29	1827		.796		1455		348		1802
30	1890		.795		1503		360		1863
35	2205		.793		1749		420		2169
40	2520		.790		1991		480		2471
45	2835		.787		2231		540		2771
50	3150		.784		2470		600		3070
55	3465		.782		2710		660		3370
60	3780		.780		2948		720		3668
65	4095		.779		3190		780		3970
70	4410		.777		3427		840		4267
75	4725		.776		3667		900		4567
80	5040		.774		3901		960		4861
85	5355		.773		4140		1020		5160
90	5670		.771		4372		1080		5452
95	5985		.771		4614		1140		5754
100	6300		.770		4851		1200		6051
110	6930		.768		5322		1320		6642
120	7560		.766		5791		1440		7231
130	8190		.764		6257		1560		7817
140	8820		.762		6721		1680		8401
150	9450		.760		7182		1800		8982
160	10080		.758		7641		1920		9561
170	10710		.756		8097		2040		10137
180	11340		.754		8550		2160		10710
190	11970		.752		9001		2280		11281
200	12600		.750		9450		2400		11850

EXHIBIT D

PIPELINE DESIGN CAPACITIES FOR RESIDENTIAL SUBDIVISIONS
1575 ft^2 Home (Old Style - 65% Eff. Furnace with R-6 Insulation)
(All Volumes in Cu. Ft. per Hr.)

Number of Customers	Heat Load	X	Diversity Factor	=	Total Heat Load	+	Base Load	=	Total Load
1	73		1.000		73		12		85
2	146		.975		142		24		166
3	219		.955		209		36		245
4	292		.937		274		48		322
5	365		.920		336		60		396
6	438		.910		399		72		471
7	511		.898		459		84		543
8	584		.886		517		96		613
9	657		.877		576		108		684
10	730		.868		634		120		754
11	803		.859		690		132		822
12	876		.852		746		144		890
13	949		.845		802		156		958
14	1022		.838		856		168		1024
15	1095		.832		911		180		1091
16	1168		.827		966		192		1158
17	1241		.823		1021		204		1225
18	1314		.818		1075		216		1291
19	1387		.815		1130		228		1358
20	1460		.812		1186		240		1426
21	1533		.809		1240		252		1492
22	1606		.807		1296		264		1560
23	1679		.804		1350		276		1626
24	1752		.802		1405		288		1693
25	1825		.800		1460		300		1760
26	1898		.799		1517		312		1829
27	1971		.798		1573		324		1897
28	2044		.797		1629		336		1965
29	2117		.796		1685		348		2033
30	2190		.795		1741		360		2101
35	2555		.793		2026		420		2446
40	2920		.790		2307		480		2787
45	3285		.787		2585		540		3125
50	3650		.784		2862		600		3462
55	4015		.782		3140		660		3800
60	4380		.780		3416		720		4136
65	4745		.779		3696		780		4476
70	5110		.777		3971		840		4811
75	5475		.776		4249		900		5149
80	5840		.774		4520		960		5480
85	6205		.773		4797		1020		5817
90	6570		.771		5066		1080		6146
95	6935		.771		5347		1140		6487
100	7300		.770		5621		1200		6821
110	8030		.768		6167		1320		7487
120	8760		.766		6710		1440		8150
130	9490		.764		7250		1560		8810
140	10220		.762		7788		1680		9468
150	10950		.760		8322		1800		10122
160	11680		.758		8853		1920		10773
170	12410		.756		9382		2040		11422
180	13140		.754		9908		2160		12068
190	13870		.752		10430		2280		12710
200	14600		.750		10950		2400		13350

EXHIBIT E

PIPELINE DESIGN CAPACITIES FOR RESIDENTIAL SUBDIVISION
2000 ft^2 Home (New Style - 75% Eff. Furnace with R-19 Insulation)
(All Volumes in Cu. Ft. per Hr.)

Number of Customers	Heat Load	X	Diversity Factor	=	Total Heat Load	+	Base Load	=	Total Load
1	63		1.000		63		12		75
2	126		.975		123		24		147
3	189		.955		181		36		217
4	252		.937		236		48		284
5	315		.920		290		60		350
6	378		.910		344		72		416
7	441		.898		396		84		480
8	504		.886		447		96		543
9	567		.877		497		108		605
10	630		.868		547		120		667
11	693		.859		595		132		727
12	756		.852		544		144		788
13	819		.845		692		156		848
14	882		.838		739		168		907
15	945		.832		786		180		966
16	1008		.827		834		192		1026
17	1071		.823		881		204		1085
18	1134		.818		928		216		1144
19	1197		.815		976		228		1204
20	1260		.812		1023		240		1263
21	1323		.809		1074		252		1326
22	1386		.807		1119		264		1383
23	1449		.804		1165		276		1441
24	1512		.802		1213		288		1501
25	1575		.800		1260		300		1560
26	1638		.799		1309		312		1621
27	1701		.798		1357		324		1681
28	1764		.797		1406		336		1742
29	1827		.796		1455		348		1802
30	1890		.795		1503		360		1863
35	2205		.793		1749		420		2169
40	2520		.790		1991		480		2471
45	2835		.787		2231		540		2771
50	3150		.784		2470		600		3070
55	3465		.782		2710		660		3370
60	3780		.780		2948		720		3668
65	4095		.779		3190		780		3970
70	4410		.777		3427		840		4267
75	4725		.776		3667		900		4567
80	5040		.774		3901		960		4861
85	5355		.773		4140		1020		5160
90	5670		.771		4372		1080		5452
95	5985		.771		4614		1140		5754
100	6300		.770		4851		1200		6051
110	6930		.768		5322		1320		6642
120	7560		.766		5791		1440		7231
130	8190		.764		6257		1560		7817
140	8820		.762		6721		1680		8401
150	9450		.760		7182		1800		8982
160	10080		.758		7641		1920		9561
170	10710		.756		8097		2040		10137
180	11340		.754		8550		2160		10710
190	11970		.752		9001		2280		11281
200	12600		.750		9450		2400		11850

EXHIBIT F

PIPELINE DESIGN CAPACITIES FOR RESIDENTIAL SUBDIVISIONS
2000 ft^2 Home (Old Style - 65% Eff. Furnace with R-19 Insulation)
(All volumes in Cu. Ft. per Hr.)

Number of Customers	Heat Load	X	Diversity Factor	=	Total Heat Load	+	Base Load	=	Total Load
1	73		1.000		73		12		85
2	146		.975		142		24		166
3	219		.955		209		36		245
4	292		.937		274		48		322
5	365		.920		336		60		396
6	438		.910		399		72		471
7	511		.898		459		84		543
8	584		.886		517		96		613
9	657		.877		576		108		684
10	730		.868		634		120		754
11	803		.859		690		132		822
12	876		.852		746		144		890
13	949		.845		802		156		958
14	1022		.838		856		168		1024
15	1095		.832		911		180		1091
16	1168		.827		966		192		1158
17	1241		.823		1021		204		1225
18	1314		.818		1075		216		1291
19	1387		.815		1130		228		1358
20	1460		.812		1186		240		1426
21	1533		.809		1240		252		1492
22	1606		.807		1296		264		1560
23	1679		.804		1350		276		1626
24	1752		.802		1405		288		1693
25	1825		.800		1460		300		1760
26	1898		.799		1517		312		1829
27	1971		.798		1573		324		1897
28	2044		.797		1629		336		1965
29	2117		.796		1685		348		2033
30	2190		.795		1741		360		2101
35	2555		.793		2026		420		2446
40	2920		.790		2307		480		2787
45	3285		.787		2585		540		3125
50	3650		.784		2862		600		3462
55	4015		.782		3140		660		3800
60	4380		.780		3416		720		4136
65	4745		.779		3696		780		4476
70	5110		.777		3971		840		4811
75	5475		.776		4249		900		5149
80	5840		.774		4520		960		5480
85	6205		.773		4797		1020		5817
90	6570		.771		5066		1080		6146
95	6935		.771		5347		1140		6487
100	7300		.770		5621		1200		6821
110	8030		.768		6167		1320		7487
120	8760		.766		6710		1440		8150
130	9490		.764		7250		1560		8810
140	10220		.762		7788		1680		9468
150	10950		.760		8322		1800		10122
160	11680		.758		8853		1920		10773
170	12410		.756		9382		2040		11422
180	13140		.754		9908		2160		12068
190	13870		.752		10430		2280		12710
200	14600		.750		10950		2400		13350

EXHIBIT G

PIPELINE DESIGN CAPACITIES FOR RESIDENTIAL SUBDIVISION
2000 ft^2 Home (Old Style - 65% Eff. Furnace with R-6 Insulation
(All Volumes in Cu. Ft. per Hr.)

Number of Customers	Heat Load	X	Diversity Factor	=	Total Heat Load	+	Base Load	=	Total Load
1	88		1.000		88		12		100
2	176		.975		172		24		196
3	264		.955		252		36		288
4	352		.937		330		48		378
5	440		.920		405		60		465
6	528		.910		481		72		553
7	616		.898		553		84		637
8	704		.886		624		96		720
9	792		.877		695		108		803
10	880		.868		764		120		884
11	968		.859		832		132		964
12	1056		.852		900		144		1044
13	1144		.845		967		156		1123
14	1232		.838		1032		168		1200
15	1320		.832		1098		180		1278
16	1408		.827		1164		192		1356
17	1496		.823		1231		204		1435
18	1584		.818		1296		216		1512
19	1672		.815		1363		228		1591
20	1760		.812		1429		240		1669
21	1848		.809		1495		252		1747
22	1936		.807		1562		264		1826
23	2024		.804		1627		276		1903
24	2112		.802		1694		288		1982
25	2200		.800		1760		300		2060
26	2288		.799		1828		312		2140
27	2376		.798		1896		324		2220
28	2464		.797		1964		336		2300
29	2552		.796		2031		348		2379
30	2640		.795		2099		360		2459
35	3080		.793		2442		420		2862
40	3520		.790		2781		480		3261
45	3960		.787		3117		540		3657
50	4400		.784		3450		600		4050
55	4840		.782		3785		660		4445
60	5280		.780		4118		720		4838
65	5720		.779		4456		780		5236
70	6160		.777		4786		840		5626
75	6600		.776		5122		900		6022
80	7040		.774		5449		960		6409
85	7480		.773		5782		1020		6802
90	7920		.771		6106		1080		7186
95	8360		.771		6446		1140		7586
100	8800		.770		6776		1200		7976
110	9680		.768		7434		1320		8754
120	10560		.766		8089		1440		9529
130	11440		.764		8740		1560		10300
140	12320		.762		9388		1680		11068
150	13200		.760		10032		1800		11832
160	14080		.758		10673		1920		12593
170	14960		.756		11310		2040		13350
180	15840		.754		11943		2160		14103
190	16720		.752		12573		2280		14853
200	17600		.750		13200		2400		15600

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2014	**Design - General**	Standard Number: **GS 2100.010**
Supersedes: N/A		Page 15 of 27

EXHIBIT H
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Flow Guidelines in MCFH, Straight Thru Flow (0.6G Specific Gravity Gas) (1000 feet length)

Steel Pipe													
Nominal Pipe Size	Wall thickness in.	ID in.	L. P.	I. P.		M. P.					H. P.		
Inlet Pressure			12” WC	5#	10#	20#	30#	40#	50#	60#	80	99	125#
	Formula		Spitz-Glass	IGT							Weymouth		
Design Pressure Drop			0.75” WC	16” WC		2#					1#		
1-1/4”	0.191	1.278	0.12	0.79	0.89	1.9	2.2	2.4	2.5	2.8	2.15	2.36	2.7
2”	0.154	2.067	0.46	2.83	3.2	6.7	7.4	8.2	9.2	9.9	7.75	8.49	9.7
3”	0.216	3.068	1.3	8.1	9.2	17.2	19.5	21.7	23.6	25.4	22.21	24.34	27
4”	0.237	4.026	2.8	16.7	19	36	40.9	45.3	49.3	53.1	45.84	50.25	55.7
6”	0.250	6.125	8.5	51.2	58.2	109	124	138	150	161	140.37	153.8	170.6
8”	0.250	8.125	17.7	108.9	123.6	227	258	286	312	335	298.23	327	362.5
10”	0.250	10.250	31.9	202.3	229.7	409	465	516	562	605	554.18	607.5	673.65
12”	0.250	12.250	49.7	325.4	369.5	638	727	805	877	944	891.47	977	1083.7
16”	0.312	15.376	86.8	596.7	677.5	1115	1270	1407	1533	1649	1634.4	1792	1986.8
20”	0.312	19.376	151.6	1105	1255	1947	2217	2457	2676	2878	3028.1	3319	3681
24	0.375	23.250	240.4	1802	2047	4874	5630	6312	6939	7523	4923.8	5397	7287
30	0.375	29.250	400	3325	3775	8991	10385	11642	12799	13878	9291	9956	11040
36	0.375	35.250	613	5469	6210	14789	17081	19149	21052	22826	14.939	16376	18160

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EXHIBIT H
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Flow Guidelines in MCFH, Straight Thru Flow (0.6G Specific Gravity Gas) (1000 feet length)

Medium Density Polyethylene (MDPE 2406/2708) MAOP 60#											
Nominal Pipe Size	SDR	Wall thickness in.	Actual ID in.	L. P.	I. P.		M. P.				
Inlet Pressure				12" WC	5#	10#	20#	30#	40#	50#	60#
Formula				Plexco Mueller							
Design Pressure Drop				0.75" WC	16" WC		2#				
1 1/4"	10	0.166	1.328	0.128	0.854	0.975	2.40	2.79	3.14	3.46	3.77
2"	11.0	0.216	1.943	0.360	2.41	2.75	6.78	7.87	8.86	9.77	10.6
3"	11.5	0.304	2.892	1.06	7.12	8.13	20	23.3	26.2	28.9	31.4
4"	11.5	0.391	3.718	2.11	14.1	16.1	39.7	46.1	51.9	57.3	62.3
6"	11.5 (IN)	0.576	5.473	6.05	40.5	46.2	113.9	132.3	149	164.3	178.7
	13.5 (NGD)	0.491	5.643	6.58	44	50.2	123.8	143.8	161.9	178.6	194.2
8"	13.5	0.639	7.347	13.5	90.4	103	254.2	295.1	332.3	366.6	398.6
12"	13.5	0.945	10.860	39.2	262	299.	737	856	964	1063	1156

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EXHIBIT H
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Flow Guidelines in MCFH, Straight Thru Flow (0.6G Specific Gravity Gas) (1000 feet length)

	High Density Polyethylene (HDPE 4710/3408) MAOP 99#													
Nominal Pipe Size		SDR	Wall thickness in.	Actual ID in.	L. P.	I. P.		M. P.					H. P.	
	Inlet Pressure				12" WC	5#	10#	20#	30#	40#	50#	60#	75#	99#
	Formula				PLEXCO Mueller									
	Design Pressure Drop				0.75" WC	16" WC		2#						
1 ¼" CTS CMA		11.0	0.121	1.133	0.08	0.55	0.63	1.59	1,81	2.04	2.25	2.44	2.719	3.120
1 ¼" IPS		11.0	0.150	1.350	0.13	0.89	1.02	2.51	2.92	3.28	3.62	3.94	4.383	5.031
2"		11.0	0.216	1.943	0.36	2.41	2.75	6.78	7.87	8.86	9.77	10.6	11.82	13.57
3"		11.0	0.318	2.864	1.04	6.94	7.92	19.5	22.7	25.5	28.1	30.6	34.04	39.06
4"		11.0	0.409	3.682	2.05	13.8	15.7	38.7	44.9	50.6	55.8	60.7	67.5	77.5
6"		11.0	0.602	5.807	7.1	47.6	54.3	134	155	175	193	210	233	268
8"		11.0	0.784	7.057	12.1	81.0	92.4	228	264	298	328	357	397	456
12"		11.0	1.1650	10.430	35.1	235	268	660	767	863	952	1036	1152	1322

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EXHIBIT H
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Flow Guidelines in MCFH, Straight Thru Flow (0.6G Specific Gravity Gas) (1000 feet length)

	High Density Polyethylene (HDPE 4710/3408) MAOP 125#														
Nominal Pipe Size	SDR	Wall thickness in.	Actual ID in.	L. P.	I. P		M. P.					H. P.			
	Inlet Pressure			12" WC	5#	10#	20#	30#	40#	50#	60#	75#	99#	110#	125#
	Formula						Plexco Mueller								
Design Pressure Drop				0.75" WC	16" WC		2#					1#			
1 – ¼"	9.0	0.154	1.292	0.12	0.79	0.9	2.23	2.59	2.91	3.22	3.5	2.619	3.004	3.168	3.38
2"	9.0	0.264	1.847	0.31	2.1	2.4	5.9	6.86	7.72	8.51	9.26	6.936	7.954	8.390	8.96
3"	9.0	0.389	2.722	0.9	6	6.89	17	19.7	22.2	24.5	26.6	19.96	22.89	24.14	25.8
4"	9.0	0.500	3.5	1.79	12	13.7	33.7	39.1	44	48.6	52.8	39.59	45.40	47.89	51.1
6"	9.0	0.736	5.153	5.14	34.4	39.2	96.7	112	126	139	151	113.6	13.03	137	146
8"	9.0	0.958	6.709	10.5	70.6	80.5	198	230	259	286	311	233.1	267.4	282	301
12"	9.0	1.417	9.916	30.6	204	233	575	668	752	830	902	676.1	775.4	818	873

EXHIBIT I
(1 OF 5)

Flow Formulae

Gas flow is normally calculated by using the Columbia Gas System or Davis flow sliderules which incorporate the Spitzglass and Weymouth formulae. The Spitzglass, Weymouth IGT and Panhandle (A or B) formulae presented are incorporated into computer programs.

Spitzglass Flow Formula

Flow of gas in mains can be computed using the Sptizglass formula as follows:

For L.P. Systems:

$$Q = 3550\ K \left(\frac{h}{GL}\right)^{1/2}$$

For I.P. and M.P. Systems:

$$Q = 4830\ K \left(\frac{Pa}{GL}\right)^{1/2}$$

where

Q = Flow per hour in cubic feet of gas at 14.73 psia (30" Hg.) and 60^{o}F.

h = Pressure drop in inches of water column.

P = Pressure drop between pipe terminals in pounds per square inch.

a = Average pressure in main, psia. (Absolute initial pressure minus half the pressure drop.)

G = Specific gravity of gas (Air = 1.0)

L = Length of pipe, feet.

d = Internal diameter of pipe, inches.

$$K = \left(\frac{d^5}{1 + \frac{3.6}{d} + 0.03d}\right)^{1/2}$$

EXHIBIT I
(2 OF 5)

Weymouth Flow Formula

The Weymouth Flow Formula is used to compute steady state flow of gas in mains and is modified to include the effect of super-compressibility:

$$Q = 0.43345\left(\frac{T_o}{P_o}\right)\cdot\left(\frac{(P_1^2 - P_2^2)\, d^{16/3}}{G\, T_f L}\right)^{1/2} (F_{pv})$$

Where Q = Flow per day at base conditions, Mcfd @ T_o and P_o

d = Internal diameter of pipe, inches

L = Length of line, miles

G = Specific Gravity of gas (Air = 1.0)

T_o = Base temperature of unit Mcf, ^oR

P_o = Base pressure of unit Mcf, psia

T_f = Average temperature of flowing gas, ^oR

P_1 = Pressure at initial end of line, psia

P_2 = Pressure at terminal end of line, psia

F_{pv} = Supercompressbility Factor. (applied above 500 psig, when required consult Engineering - Facilities Planning)

EXHIBIT I
(3 OF 5)

IGT Flow Formula

The IGT flow formula is most commonly used for M.P. and H.P. sizing:

$$Q = 0.6643 \left(\frac{T_o}{P_o}\right)\left(\frac{P_1^2 - P_2^2}{T_f L}\right)^{5/9} \frac{D^{8/3}}{G\,\overline{4/9}_u 1/9}$$

Where Q = Flow per hour at base conditions, MCF/hr. @ T_o and P_o

T_o = Base temperature of unit MCF, ^oR

P_o = Base pressure of unit, psia

P_1 = Pressure at initial end of line, psia

P_2 = Pressure at terminal end of line, psia

T_f = Average temperature of flowing gas, ^oR

L = Length of line, feet

D = Internal diameter of pipe, inches

G = Specific gravity of gas (Air = 1.0)

u = 7.0×10^{-6} lb_M/ft.-sec.

EXHIBIT I
(4 OF 5)

Panhandle (A or B) Flow Formulae

The Panhandle (A or B) formula simulates transmission mains, where pressures are above 200 psig, length is over 5 miles, and the diameter is 6" to 16".

Panhandle A

The Panhandle A equation is a reasonable approximation of partially turbulent flow behavior, when adjusted with efficiency factor, E. Many users assume an efficiency factor of 0.92.

$$Q = 435.87 \left(\frac{T_b}{P_b}\right)^{1.0788} \left(\frac{P_1^2 - P_2^2}{S^{0.853} L_m \, T_{avg} \, Z_{avg}}\right)^{0.5392} d^{2.6182}$$

Panhandle B

The revised (1956) Panhandle equation more nearly approximates fully turbulent flow behavior. The efficiency factor, E varies between about 0.88 and 0.94.

$$Q = 737 \left(\frac{T_b}{P_b}\right)^{1.02} E \left(\frac{P_1^2 - P_2^2}{S^{0.961} L_m \, T_{avg} \, Z_{avg}}\right)^{0.51} d^{2.53}$$

In both equations:

Q = Flow rate of gas, cubic feet per day at base conditions

T_b = Base absolute temperature, T_b=520°R)

P_b = Base absolute pressure, P_b=14.73 psia)

E = Pipeline efficiency factor

P_1 = Inlet pressure, psia

P_2 = Outlet pressure, psia

S = Specific gravity of gas (air = 1.0)

L_m = Length of line, miles

T_{avg} = Average temperture, °R, [$T_{avg} = \frac{1}{2}(T_{in}+T_{out})$]

Z_{avg} = Average compressibility factor

d = Internal diameter of pipe, inches

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Plexco Mueller Low Pressure Flow Formulae < 1 PSIG inlet pressure

$$Q_h = \frac{2971d^{2.725}}{S_g^{0.425}} \left(\frac{h1 - h2}{L} \right)^{0.575}$$

Q_h = Flow Rate in SCFH

S_g = Specific Gravity

h1 = Inlet Pressure inH_2O

h2 = Outlet Pressure in H_2O

L = Length ft

d = Inside Diameter in

Plexco Mueller High Pressure Flow Formulae > 1 PSIG inlet pressure

$$Q_h = \frac{2826d^{2.725}}{S_g^{0.425}} \left(\frac{(P1+ 14.7)^2 - (P2+14.7)^2}{L} \right)^{0.575}$$

Q_h = Flow Rate in SCFH

S_g = Specific Gravity

P1 = Inlet Pressure psig

P2 = Outlet Pressure psig

L = Length ft

d = Inside Diameter in

EXHIBIT J
(1 OF 4)

TABLE FOR SQUARES OF THE ABLSOLUTE PRESSURES

P_{atm} = 14.4 PSIA T_f = 50°F G = 0.600

PSIG	0	1	2	3	4	5	6	7	8	9
0	207.	237.	269.	302.	338.	376.	416.	458.	502.	548.
10	596.	645.	697.	751.	807.	865.	925.	987.	1051.	1117.
20	1186.	1256.	1328.	1402.	1478.	1556.	1636.	1719.	1803.	1889.
30	1978.	2068.	2160.	2255.	2351.	2450.	2550.	2653.	2757.	2864.
40	2972.	3083.	3196.	3310.	3427.	3546.	3667.	3789.	3914.	4041.
50.	4170.	4301.	4434.	4569.	4707.	4846.	4987.	5130.	5276.	5423.
60	5572.	5724.	5877.	6033.	6191.	6350.	6512.	6676.	6841.	7009.
70	7179.	7351.	7525.	7701.	7880.	8060.	8242.	8426.	8613.	8801.
80	8992.	9184.	9379.	9576.	9774.	9975.	10178.	10383.	10590.	10799.
90	11010.	11223.	11439.	11656.	11875.	12097.	12321.	12546.	12774.	13004.
100	13236.	13470.	13705.	13944.	14184.	14426.	14670.	14917.	15165.	15416.
110	15669.	15923.	16180.	16439.	16700.	16963.	17228.	17496.	17765.	18036.
120	18310.	18585.	18863.	19143.	19425.	19709.	19995.	20283.	20574.	20866.
130	21160.	21457.	21755.	22056.	22359.	22664.	22971.	23280.	23592.	23905.
140	24221.	24538.	24858.	25180.	25504.	25830.	26158.	26488.	26820.	27155.
150	27491.	27830.	28171.	28514.	28859.	29206.	29555.	29906.	30260.	30616.
160	30973.	31333.	31695.	32059.	32426.	32794.	33164.	33537.	33912.	34288.
170	34667.	35049.	35432.	35817.	36205.	36594.	36986.	37380.	37776.	38174.
180	38574.	38977.	39381.	39788.	40197.	40608.	41021.	41436.	41854.	42273.
190	42695.	43119.	43544.	43973.	44403.	44835.	45270.	45706.	46145.	46586.
200	47029.	47475.	47922.	48372.	48823.	49277.	49733.	50192.	50652.	51114.
210	51579.	52046.	52515.	52986.	53460.	53935.	54413.	54893.	55374.	55859.
220	56345.	56833.	57324.	57817.	58312.	58809.	59308.	59810.	60313.	60819.
230	61327.	61837.	62350.	62864.	63381.	63900.	64421.	64944.	65470.	65997.
240	66527.	67059.	67593.	68129.	68668.	69209.	69751.	70296.	70844.	71393.
250	71945.	72499.	73055.	73613.	74173.	74736.	75300.	75867.	76437.	77008.
260	77581.	78157.	78735.	79315.	79898.	80482.	81069.	81658.	82249.	82842.
270	83438.	84036.	84636.	85238.	85842.	86449.	87057.	87669.	88282.	88897.
280	89515.	90135.	90757.	91381.	92008.	92636.	93267.	93900.	94536.	95173.
290	95813.	96455.	97099.	97746.	98395.	99046.	99699.	100354.	101012.	101672.
300	102334.	102998.	103664.	104333.	105004.	105677.	106353.	107031.	107711.	108393.
310	109077.	109764.	110453.	111144.	111837.	112533.	113231.	113931.	114633.	115338.
320	116045.	116753.	117465.	118178.	118894.	119612.	120332.	121055.	121780.	122507.
330	123236.	123968.	124702.	125438.	126176.	126917.	127660.	128405.	129152.	129902.
340	130654.	131408.	132164.	132923.	133684.	134447.	135213.	135980.	136750.	137523.
350	138297.	139074.	139853.	140635.	141419.	142204.	142992.	143783.	144576.	145371.
360	146168.	146968.	147770.	148574.	149380.	150189.	151000.	151813.	152629.	153447.
370	154267.	155089.	155914.	156741.	157570.	158402.	159236.	160072.	160910.	161751.
380	162594.	163440.	164287.	165137.	165989.	166844.	167701.	168560.	169421.	170285.
390	171151.	172020.	172890.	173763.	174639.	175516.	176396.	177278.	178163.	179050.

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PSIG	0	1	2	3	4	5	6	7	8	9
400	179939.	180830.	181724.	182620.	183519.	184419.	185323.	186228.	187136.	188046.
410	188958.	189873.	190790.	191709.	192631.	193554.	194481.	195410.	196340.	197274.
420	198209.	199147.	200087.	201030.	201975.	202922.	203872.	204824.	205778.	206734.
430	207693.	208655.	209618.	210584.	211552.	212523.	213496.	214471.	215449.	216429.
440	217411.	218396.	219383.	220373.	221365.	222359.	223355.	224354.	225355.	226359.
450	227364.	228373.	229383.	230396.	231412.	232429.	233449.	234472.	235497.	236524.
460	237553.	238585.	239619.	240656.	241695.	242736.	243780.	244826.	245874.	246925.
470	247979.	249034.	250092.	251152.	252215.	253280.	254348.	255417.	256489.	257564.
480	258641.	259720.	260802.	261886.	262973.	264062.	265153.	266247.	267343.	268441.
490	269542.	270646.	271751.	272859.	273970.	275082.	276198.	277315.	278435.	279558.
500	280682.	281809.	282939.	284071.	285205.	286342.	287481.	288622.	289765.	290912.
510	292061.	293212.	294366.	295521.	296680.	297840.	299004.	300169.	301337.	302508.
520	303680.	304856.	306033.	307213.	308396.	309581.	310768.	311958.	313150.	314344.
530	315542.	316741.	317943.	319147.	320354.	321563.	322775.	323989.	325205.	326424.
540	327645.	328869.	330095.	331324.	332555.	333788.	335024.	336263.	337503.	338747.
550	339992.	341240.	342491.	343744.	345000.	346258.	347518.	348781.	350046.	351314.
560	352584.	353857.	355132.	356409.	357689.	358972.	360257.	361544.	362834.	364126.
570	365421.	366718.	368018.	369320.	370625.	371932.	373241.	374553.	375868.	377185.
580	378504.	379826.	381150.	382477.	383806.	385138.	386472.	387809.	389149.	390490.
590	391834.	393181.	394530.	395882.	397236.	398592.	399952.	401313.	402677.	404044.
600	405413.	406784.	408158.	409535.	410913.	412295.	413679.	415065.	416454.	417846.
610	419240.	420636.	422035.	423436.	424840.	426247.	427656.	429067.	430481.	431898.
620	433317.	434738.	436162.	437588.	439017.	440449.	441883.	443320.	444759.	446200.
630	447644.	449091.	450540.	451992.	453446.	454902.	456361.	457823.	459287.	460754.
640	462223.	463695.	465170.	466646.	468126.	469608.	471092.	472579.	474068.	475561.
650	477055.	478552.	480052.	481554.	483059.	484566.	486076.	487588.	489103.	490620.
660	492140.	493663.	495188.	496715.	498246.	499778.	501313.	502851.	504391.	505934.
670	507479.	509028.	510578.	512131.	513687.	515245.	516806.	518369.	519935.	521503.
680	523074.	524648.	526224.	527802.	529384.	530967.	532554.	534143.	535734.	537328.
690	538925.	540524.	542126.	543730.	545337.	546947.	548559.	550173.	551791.	553410.
700	555033.	556658.	558285.	559915.	561548.	563183.	564821.	566461.	568105.	569750.
710	571398.	573049.	574702.	576359.	578017.	579678.	581342.	583008.	584677.	586349.
720	588023.	589699.	591379.	593061.	594745.	596432.	598122.	599814.	601509.	603207.
730	604907.	606610.	608315.	610023.	611733.	613447.	615162.	616881.	618602.	620325.
740	622052.	623780.	625512.	627246.	628983.	630722.	632464.	634208.	635956.	637705.
750	639458.	641212.	642969.	644729.	646491.	648256.	650024.	651793.	653565.	655342.
760	657120.	658901.	660684.	662470.	664258.	666049.	667843.	669640.	671439.	673241.
770	675045.	676852.	678662.	680474.	682289.	684106.	685927.	687750.	689575.	691403.
780	693234.	695067.	696903.	698742.	700583.	702427.	704274.	706123.	707975.	709830.
790	711687.	713547.	715409.	717275.	719143.	721013.	722887.	724762.	726641.	728522.

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PSIG	0	1	2	3	4	5	6	7	8	9
800	730406.	732293.	734182.	736074.	737968.	739865.	741765.	743668.	745573.	747481.
810	749391.	751304.	753220.	755139.	757060.	758984.	760910.	762840.	764772.	766706.
820	768644.	770583.	772526.	774471.	776419.	778370.	780324.	782280.	784238.	786199.
830	788164.	790131.	792100.	794072.	796047.	798025.	800005.	801988.	803973.	805962.
840	807953.	809947.	811943.	813942.	815944.	817949.	819956.	821966.	823978.	825994.
850	828012.	830032.	832056.	834082.	836111.	838142.	840177.	842214.	844253.	846296.
860	848341.	850389.	852439.	854493.	856548.	858607.	860669.	862733.	864800.	866869.
870	868941.	871017.	873094.	875174.	877258.	879344.	881432.	883524.	885618.	887714.
880	889814.	891916.	894021.	896129.	898239.	900353.	902469.	904587.	906709.	908833.
890	910960.	913089.	915222.	917357.	919495.	921635.	923778.	925924.	928073.	930225.
900	932379.	934536.	936696.	938858.	941023.	943191.	945362.	947535.	949712.	951891.
910	954073.	956257.	958444.	960634.	962827.	965023.	967221.	969422.	971626.	973832.
920	976042.	978253.	980468.	982686.	984906.	987129.	989355.	991584.	993815.	996049.
930	998286.	1000526.	1002769.	1005014.	1007262.	1009513.	1011766.	1014022.	1016281.	1018544.
940	1020808.	1023075.	1025345.	1027619.	1029894.	1032173.	1034454.	1036738.	1039025.	1041315.
950	1043607.	1045902.	1048200.	1050501.	1052804.	1055111.	1057420.	1059732.	1062047.	1064364.
960	1066685.	1069007.	1071333.	1073662.	1075993.	1078327.	1080665.	1083005.	1085347.	1087692.
970	1090041.	1092392.	1094745.	1097102.	1099462.	1101823.	1104189.	1106556.	1108927.	1111300.
980	1113677.	1116056.	1118437.	1120822.	1123209.	1125599.	1127993.	1130388.	1132787.	1135189.
990	1137593.	1140000.	1142409.	1144822.	1147238.	1149656.	1152077.	1154501.	1156928.	1159357.
1000	1161790.	1164224.	1166661.	1169102.	1171544.	1173990.	1176439.	1178890.	1181344.	1183801.
1010	1186261.	1188723.	1191189.	1193657.	1196128.	1198602.	1201079.	1203558.	1206041.	1208526.
1020	1211014.	1213504.	1215998.	1218495.	1220994.	1223496.	1226001.	1228509.	1231019.	1233533.
1030	1236049.	1238568.	1241090.	1243615.	1246143.	1248673.	1251206.	1253743.	1256281.	1258823.
1040	1261368.	1263915.	1266465.	1269019.	1271575.	1274133.	1276695.	1279260.	1281827.	1284397.
1050	1286970.	1289546.	1292125.	1294707.	1297291.	1299878.	1302468.	1305061.	1307657.	1310256.
1060	1312857.	1315461.	1318068.	1320679.	1323291.	1325907.	1328526.	1331147.	1333771.	1336399.
1070	1339029.	1341661.	1344297.	1346935.	1349577.	1352221.	1354869.	1357518.	1360171.	1362827.
1080	1365486.	1368147.	1370811.	1373478.	1376148.	1378821.	1381497.	1384176.	1386857.	1389542.
1090	1392229.	1394918.	1397612.	1400308.	1403006.	1405707.	1408412.	1411119.	1413829.	1416542.
1100	1419258.	1421976.	1424698.	1427423.	1430150.	1432880.	1435614.	1438349.	1441088.	1443830.
1110	1446574.	1449322.	1452072.	1454826.	1457581.	1460340.	1463102.	1465867.	1468634.	1471405.
1120	1474178.	1476955.	1479734.	1482516.	1485301.	1488088.	1490879.	1493672.	1496469.	1499267.
1130	1502070.	1504875.	1507683.	1510494.	1513307.	1516124.	1518944.	1521765.	1524591.	1527419.
1140	1530250.	1533084.	1535921.	1538760.	1541602.	1544448.	1547296.	1550148.	1553002.	1555859.
1150	1558719.	1561582.	1564447.	1567316.	1570186.	1573061.	1575938.	1578818.	1581701.	1584587.
1160	1587476.	1590367.	1593262.	1596160.	1599060.	1601963.	1604870.	1607778.	1610690.	1613605.
1170	1616523.	1619444.	1622367.	1625294.	1628223.	1631155.	1634090.	1637028.	1639969.	1642913.
1180	1645860.	1648809.	1651762.	1654717.	1657675.	1660637.	1663600.	1666568.	1669538.	1672511.
1190	1675486.	1678465.	1681446.	1684431.	1687418.	1690408.	1693402.	1696398.	1699397.	1702398.

EXHIBIT J
(4 OF 4)

PSIG	0	1	2	3	4	5	6	7	8	9
1200	1705403.	1708411.	1711422.	1714435.	1717451.	1720471.	1723493.	1726518.	1729546.	1732577.
1210	1735611.	1738648.	1741687.	1744730.	1747775.	1750824.	1753875.	1756929.	1759986.	1763046.
1220	1766109.	1769175.	1772244.	1775316.	1778390.	1781467.	1784548.	1787631.	1790718.	1793807.
1230	1796899.	1799994.	1803092.	1806192.	1809296.	1812402.	1815512.	1818625.	1821740.	1824858.
1240	1827980.	1831103.	1834230.	1837360.	1840493.	1843629.	1846768.	1849909.	1853054.	1856201.
1250	1859351.	1862506.	1865663.	1868823.	1871987.	1875153.	1878322.	1881494.	1884669.	1887847.
1260	1891028.	1894212.	1897398.	1900587.	1903780.	1906975.	1910174.	1913375.	1916579.	1919786.
1270	1922996.	1926209.	1929425.	1932644.	1935865.	1939090.	1942317.	1945548.	1948781.	1952017.
1280	1955257.	1958499.	1961744.	1964992.	1968243.	1971497.	1974753.	1978013.	1981276.	1984541.
1290	1987810.	1991081.	1994355.	1997633.	2000913.	2004196.	2007482.	2010770.	2014062.	2017357.
1300	2020655.	2023955.	2027259.	2030565.	2033874.	2037187.	2040502.	2043820.	2047141.	2050465.
1310	2053792.	2057121.	2060454.	2063790.	2067128.	2070470.	2073814.	2077162.	2080511.	2083865.
1320	2087221.	2090580.	2093942.	2097307.	2100675.	2104046.	2107419.	2110795.	2114174.	2117557.
1330	2120942.	2124330.	2127722.	2131116.	2134513.	2137912.	2141315.	2144721.	2148130.	2151542.
1340	2154955.	2158373.	2161793.	2165216.	2168643.	2172072.	2175504.	2178938.	2182376.	2185817.
1350	2189261.	2192707.	2196157.	2199610.	2203064.	2206523.	2209984.	2213448.	2216915.	2220385.
1360	2223858.	2227333.	2230812.	2234294.	2237778.	2241265.	2244756.	2248249.	2251745.	2255244.
1370	2258746.	2262251.	2265758.	2269269.	2272783.	2276299.	2279819.	2283341.	2286867.	2290395.
1380	2293926.	2297460.	2300996.	2304536.	2308079.	2311625.	2315173.	2318725.	2322279.	2325836.
1390	2329396.	2332960.	2336526.	2340094.	2343666.	2347241.	2350818.	2354399.	2357983.	2361569.
1400	2365158.	2368750.	2372345.	2375943.	2379544.	2383148.	2386754.	2390364.	2393976.	2397592.
1410	2401210.	2404831.	2408455.	2412082.	2415712.	2419345.	2422980.	2426619.	2430260.	2433905.
1420	2437552.	2441202.	2444855.	2448511.	2452170.	2455832.	2459496.	2463164.	2466834.	2470507.
1430	2474184.	2477863.	2481545.	2485230.	2488917.	2492608.	2496301.	2499998.	2503697.	2507399.
1440	2511104.	2514813.	2518523.	2522237.	2525954.	2529674.	2533396.	2537122.	2540850.	2544580.
1450	2548315.	2552051.	2555792.	2559534.	2563280.	2567028.	2570779.	2574533.	2578290.	2582050.
1460	2585813.	2589578.	2593347.	2597119.	2600893.	2604670.	2608450.	2612233.	2616019.	2619808.
1470	2623600.	2627394.	2631191.	2634991.	2638795.	2642600.	2646409.	2650221.	2654036.	2657853.
1480	2661673.	2665496.	2669322.	2673151.	2676983.	2680818.	2684655.	2688495.	2692338.	2696185.
1490	2700034.	2703886.	2707740.	2711598.	2715458.	2719321.	2723188.	2727057.	2730928.	2734803.

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Distribution Operations

Gas Standard

Effective Date: 01/01/2013	**Piping System Names and Identifiers**	Standard Number: **GS 2100.015**
Supersedes: 09/01/2008		Page 1 of 3

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE

1. GENERAL

The purpose of this gas standard is to provide guidance in assigning a name and identifier to a **piping system**.

A piping system is a network of **pipeline**s. A piping system normally originates at a supply to the network (e.g., **point of delivery** (POD), district regulator station, etc.) and terminates at either a **control point**(s) or at the outlet of a customer meter(s).

A **market** consists of one piping system or several interconnecting piping systems that are supplied by an **interchange**, a POD, or multiple interconnecting interchanges and/or PODs.

A unique name and identifier should be assigned to each piping system. Engineering is responsible for assigning appropriate piping system names and identifiers. The initial assignment of piping system names and identifiers, if not already completed, should be completed during the implementation of Work Management (WM) and/or Geographical Information System (GIS).

Piping system names and identifiers will be linked in the Work Management/Geographical Information System (WM/GIS), by relating customers, MAOP, pipeline components, etc. These should also correspond to the DIS customer information system for the Columbia LDCs, if applicable.

Exhibit A shows examples of several systems and the related market.

2. PIPING SYSTEM NAME

Each piping system name could include the name of the city/town or the name of the Company division and a pressure designation (e.g., Brockton LP). The piping system name may include a street name or a regulator station location (e.g., Chantilly – SR50 MP).

3. PIPING SYSTEM IDENTIFIER

Each piping system identifier should consist of eight alphanumeric characters as follows:

AABBBCCC

AA – Company number: Table 1 includes a list of Company numbers.

BBB – market identifier (e.g., 001, 201, 443, etc.): Randomly assigned number.

CCC – system identifier (e.g., 001, 002, 003, A01, etc.):

The system identifier shall be unique to the company and market.

New piping system identifiers should be entered into the DIS customer information system for the Columbia LDCs by Gas Systems Planning, if applicable.

Table 1

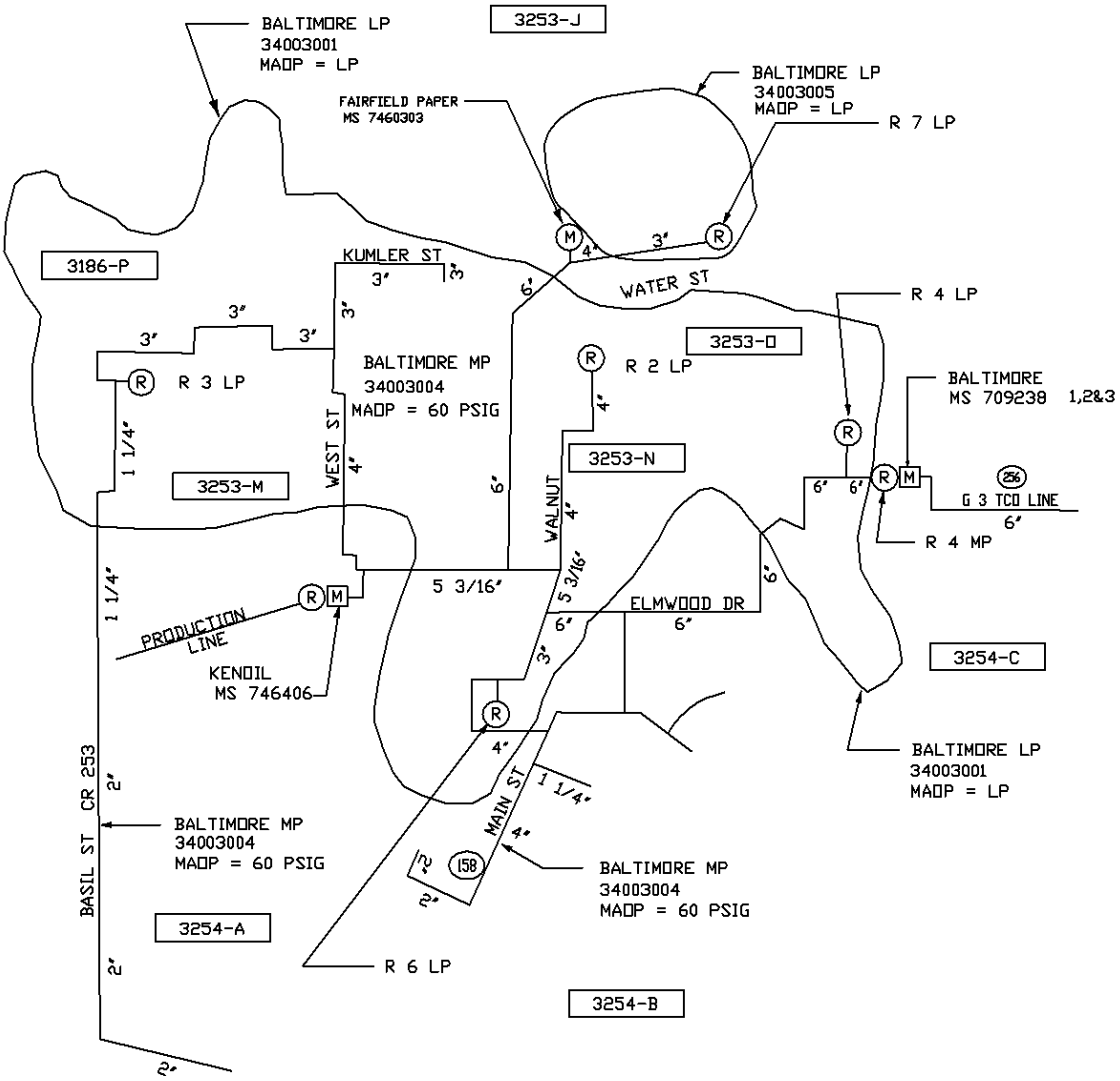
Company	Company Number
Columbia Gas of Massachusetts	80
Columbia Gas of Kentucky, Inc.	32
Columbia Gas of Maryland, Inc.	35
Columbia Gas of Ohio, Inc.	34
Columbia Gas of Pennsylvania, Inc.	37
Columbia Gas of Virginia, Inc.	38
Northern Indiana Public Service Company	59

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2013	**Piping System Names and Identifiers**	Standard Number: **GS 2100.015**
Supersedes: 09/01/2008		Page 3 of 3

EXHIBIT A



Company No.: 34, Ohio

Market Identifier:
34003, Baltimore
Supplied by two PODs: MS 709238 off TCO line G3
& MS 745406 off Kenoil Production

Piping System Identifiers:
34003001, Baltimore LP; supplied by R2, R3, R4, & R6
34003004, Baltimore MP; supplied by R4 and regulation @ MS 745406
34003005, Baltimore LP; supplied by R7

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Distribution Operations

Gas Standard

Effective Date: 06/01/2012	**Components Fabricated By Welding**	Standard Number: **GS 2100.020**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.153

1. GENERAL

The purpose of this standard is to provide the minimum requirements for the design of new components fabricated by welding.

2. DESIGN PRESSURE

Except for branch connections and assemblies of standard pipe and fittings joined by circumferential welds, the design pressure of each component fabricated by welding, whose strength cannot be determined, shall be established in accordance with paragraph UG-101 (Proof Tests to Establish Maximum Allowable Working Pressure) of section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code (2007 edition, July 1, 2007).

3. PREFABRICATED UNITS THAT USE PLATE AND LONGITUDINAL SEAMS

Each prefabricated unit that uses plate and longitudinal seams shall be designed, constructed, and tested in accordance with section VIII, Division 1, or section VIII, Division 2 of the ASME Boiler and Pressure Vessel Code (2007 edition, July 1, 2007), except for the following.

a. Regularly manufactured butt-welding fittings.

b. Pipe that has been produced and tested under a specification listed in Company standard PIP 0030.

c. Partial assemblies such as split rings or collars.

d. Prefabricated units that the manufacturer certifies have been tested to at least twice the maximum pressure to which they will be subjected under the anticipated operating conditions.

4. ORANGE-PEEL BULL PLUGS AND SWAGES

Orange-peel bull plugs and orange-peel swages shall not be used on pipelines that are to operate at a hoop stress of 20 percent or more of the SMYS of the pipe.

5. FLAT CLOSURES AND FISH TAILS

Except for flat closures designed in accordance with section VIII of the ASME Boiler and Pressure Code, flat closures and fish tails shall not be used on pipe that either operates 100 psig, or more, or is more than 3 inches nominal diameter.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 1 of 87

Companies Affected:

☑ NIPSCO	☑ CGV ☑ CKY ☑ CMA	☑ CMD ☑ COH ☑ CPA

REFERENCE 49 CFR Part 192.53, 192.55, 192.103, 192.105, 192.107, 192.109, 192.111, 192.113, 192.115; 220 CMR 109.08

1. GENERAL

The purpose of this standard is to provide the minimum requirements for the design of new steel pipe and to determine the design pressure for existing steel pipe.

Pipe must be designed with sufficient wall thickness and yield strength, or must be installed with adequate protection, to withstand anticipated external pressures and loads that will be imposed on the pipe after installation.

Typically, new steel pipe with an intended **Maximum Allowable Operating Pressure (MAOP)** of 99 psig or less and purchased at current Company specifications is not considered a **transmission line** according to the design formula (see Section 2 below). To design a **pipeline** for an MAOP of 100 psig or more, the engineer will need to consider combinations of diameter, wall thickness, and yield strength, along with economics and material availability. If practical, a pipeline should be designed to operate less than 20 percent of the **Specified Minimum Yield Strength (SMYS)** (see Section 2.1 below). If a pipeline is designed to operate at 20 percent SMYS or more, it meets the definition of a transmission line, which requires additional design considerations as well as additional operating, maintenance, and Integrity Management Program (49 CFR Part 192 Subpart O – Gas Transmission Pipeline Integrity Management) responsibilities. Contact the Transmission and M&R Design group if the design appears to meet the definition of a transmission line.

NOTE: Other factors of the design of a pipeline may also meet the definition of a transmission line.

For steel pipelines with less than 24” cover or with abnormal loading conditions, consideration shall be given to providing additional protection or increasing the yield strength or wall thickness of the pipe. (See Pipeline Toolbox – Gas Edition for stress calculation tools.)

2. DESIGN FORMULA

The design pressure for steel pipe is determined in accordance with the following formula:

$$P = (2St/D) \times F \times E \times T$$

Where,

P	=	Design pressure, psig
S	=	Specified Minimum Yield Strength (SMYS), psi
t	=	Wall thickness, inches
D	=	Outside diameter, inches
F	=	Design factor
E	=	Longitudinal joint factor
T	=	Temperature derating factor

2.1 Specified Minimum Yield Strength (SMYS)

The Specified Minimum Yield Strength (SMYS) means:

a. For steel pipe manufactured in accordance with a listed specification, the yield strength specified as a minimum in that specification; or

b. For steel pipe manufactured in accordance with an unknown or unlisted specification, the yield strength determined in accordance with §192.107(b) Yield strength (S) for steel pipe.

Table 1 lists the SMYS of some of the more commonly used steel line pipe historically. For existing steel pipe with a specification or tensile properties that are unknown, 24,000 psi shall be used as the SMYS in the design formula, unless the pipe is tensile tested in accordance with the American Petroleum Institute (API) Specification 5L.

2.1.1 Massachusetts Specific Requirements

In Massachusetts, for pipelines operating above an MAOP of 200 psig, all steel pipe six inches or greater in diameter shall have a SMYS of at least 35,000 psi.

Table 1

SPECIFIED MINIMUM YIELD STRENGTH (SMYS)	
Specification	**SMYS (psi)**
API 5L Class 1 (Grade A25) Continuous Butt-Welded	25,000
API 5L Grade A Seamless or Electric-Welded	30,000
API 5L Grade B Seamless or Electric-Welded	35,000
API 5L Butt-Welded Class I Open-Hearth[1]	25,000
API 5L Butt-Welded Class II Open-Hearth[1]	28,000
API 5L Butt-Welded Open—Hearth Iron	24,000
API 5LX Grade X42	42,000
API 5LX Grade X46	46,000
API 5LX Grade X52	52,000
API 5LX Grade X56	56,000
API 5LX Grade X60	60,000
API 5LX Grade X65	65,000
API 5LX Grade X70	70,000
ASTM A 53 Grade A	30,000
ASTM A 53 Grade B	35,000
ASTM A 53 Butt-Welded Open-Hearth or Electric Furnace	25,000
ASTM A 72	24,000
ASTM A 106 Grade A	30,000
ASTM A 106 Grade B	35,000
ASTM A 135 Grade A	30,000
ASTM A 135 Grade B	35,000
ASTM A 139 Grade A	30,000
ASTM A 139 Grade B	35,000

[1] API 5L Butt-Welded Class I and II Open-Hearth pipe and ASTM A 53 Butt-Welded Open-Hearth or Electric Furnace pipe shall not be used in excess of 300 psig.

2.2 Wall Thickness (t)

Refer to gas standards GS 2100.010 “Design – General” and PIP 0030 “Electric Resistance Welded Pipe Specifications” for current wall thickness specifications for new steel pipe.

Consideration should be given to specifying a greater wall thickness for steel pipe with anticipated external loads, such as steel pipe designed for above ground use or at railroad crossings.

Additional wall thickness that may be specified to account for anticipated external loads should not be included in computing design pressure. For example, if the standard order for 12” steel pipe has a wall thickness of 0.250” and a SMYS of 42,000 psi, the design pressure is calculated to be 328 psig for distribution pipeline. Specifying an increased wall thickness of 0.375” for the design of an above ground bridge crossing does not automatically allow an increased design pressure.

If the wall thickness of existing steel pipe is unknown, the minimum wall thickness for the pipe diameter indicated in the “Properties of Pipe” tables (Exhibit A) may be used in the design formula. Some field investigation or other records research may be necessary to validate using the minimum wall thickness. If additional investigation is deemed necessary, the method for determining wall thickness is prescribed in accordance with §192.109 Nominal wall thickness (t) for steel pipe.

2.2.1 Massachusetts Specific Requirements

In Massachusetts, for pipelines operating above an MAOP of 200 psig, all steel pipe six inches or greater in diameter shall have a wall thickness of at least 0.280 inches, and all steel pipe less than six inches in diameter shall be at least Schedule 40 wall thickness.

2.3 Outside Diameter (D)

The outside diameter for typical pipe sizes can be found in the “Properties of Pipe” tables (Exhibit A).

For atypical pipe sizes, the outside diameter for the next larger size pipe (i.e. for 3 ½”, use an outside diameter of 4.500”) may be used in the design formula. If additional investigation is deemed necessary, field measurements should be taken to obtain the actual outside diameter.

2.4 Design Factor (F)

A design factor of less than 0.20 shall be used to design distribution pipeline. For transmission lines, the design factor is determined in accordance with the class location indicated in Table 2.

Table 2

DESIGN FACTOR (F)		
Class Location	**Conditional Factors**	**Maximum Design Factor (F)**
4	All areas.	0.40
3	All areas.	0.50
2	Pipeline within a compressor station, regulating station, or measuring station, or Uncased pipeline crossing of the right-of-way of a hard surfaced road, highway, public street, or railroad.	0.50
	All other areas.	0.60
1	Pipeline within a compressor station, regulating station, or measuring station.	0.50
	Uncased pipeline crossing of the right-of-way of an unimproved public road, hard surfaced road, highway, public street, or railroad, or Parallel pipeline encroachment on the right-of-way of a hard surfaced road, highway, public street, or railroad, or Pipeline supported by a vehicular, pedestrian, railroad, or pipeline bridge, or Pipeline used in a fabricated assembly, (including separators, mainline valve assemblies, cross-connections, and river crossing headers) or is used within five pipe diameters in any direction from the last fitting of a fabricated assembly, other than a transition piece or an elbow used in place of a pipe bend which is not associated with a fabricated assembly.	0.60
	All other areas.	0.72

2.5 Longitudinal Joint Factor (E)

The longitudinal joint factor to be used in the design formula is determined in accordance with Table 3.

Table 3

LONGITUDINAL JOINT FACTOR (E)		
Specification	**Pipe Class**	**E**
API 5L	Seamless	1.00
	Electric Resistance Welded	1.00
	Electric Flash Welded	1.00
	Submerged Arc Welded	1.00
	Furnace Butt Welded	0.60
ASTM A53/A53M	Seamless	1.00
	Electric Resistance Welded	1.00
	Furnace Butt Welded	0.60
ASTM A106	Seamless	1.00
ASTM A133/A333M	Seamless	1.00
	Electric resistance welded	1.00
ASTM A381	Double submerged arc welded	1.00
ASTM A671	Electric fusion welded	1.00
ASTM A672	Electric fusion welded	1.00
ASTM A691	Electric fusion welded	1.00
Other	Pipe over 4 inches	0.80
Other	Pipe 4 inches or less	0.60

If the type of longitudinal joint cannot be determined, the joint factor to be used must not exceed that designated for "Other."

2.6 Temperature Derating Factor (T)

A temperature derating factor of 1.000 is used for gas temperatures of 250°F or less.

3. DESIGN PRESSURE TABLES

The “Design Pressure” tables (Exhibit B) provide design pressures for various design factors (F), using a factor of 1.0 for “E” and “T”. If a factor other than 1.0 is required for “E” or “T”, the listed pressure can be multiplied by the appropriate factor(s) to obtain the actual design pressure.

NOTE: For furnace butt welded pipe, the Maximum Allowable Operating Pressure (MAOP) may not exceed 300 psig.

To use the tables, first find the tables with the appropriate SMYS specification, then for the particular pipe diameter and wall thickness, follow the row across to the appropriate design factor column. For example, the design pressure for a new transmission line with the following specifications, 12”, 0.250” wall thickness, SMYS = 42,000 psig, located within a Class 4 location is 659 psig (“E” and “T” factors equal 1.0).

4. OTHER DESIGN CONSIDERATIONS

4.1 Welding

The design engineer should choose the appropriate combination of diameter, wall thickness, and yield strength which is compatible with the properties of the weld fittings and welding procedures to be used to join the pipe. Otherwise, the weld fittings may have to be field tapered, new weld procedures may have to be developed, and welders may have to be qualified to those new procedures.

4.2 Components

Components of steel pipelines, such as valves, fittings, regulators, etc., shall be carefully selected to withstand without impairment the anticipated MAOP and secondary stresses. Manufacturers’ ratings established by testing shall be used in determining the components' suitability for service.

4.3 Threaded Steel Pipe

Threaded steel pipe shall not be used in buried pipelines.

EXHIBIT A
(1 of 8)

PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	PIPE VOLUME PER FOOT [U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	SURFACE AREA/FT OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
1/2	0.109	STD - 40	0.85	2.2	0.840	0.622	0.30	0.002	0.02	0.16	0.22	0.25	0.203
1/2	0.147	XS - 80	1.09	2.9	0.840	0.546	0.23	0.002	0.01	0.14	0.22	0.32	0.178
1/2	0.188	160	1.31	3.5	0.840	0.464	0.17	0.001	0.01	0.12	0.22	0.39	0.151
1/2	0.294	XXS	1.71	4.5	0.840	0.252	0.05	0.000	0.00	0.07	0.22	0.50	0.082
3/4	0.113	STD - 40	1.13	3.0	1.050	0.824	0.53	0.004	0.03	0.22	0.27	0.33	0.269
3/4	0.154	XS - 80	1.47	3.9	1.050	0.742	0.43	0.003	0.02	0.19	0.27	0.43	0.242
3/4	0.219	160	1.94	5.1	1.050	0.612	0.29	0.002	0.02	0.16	0.27	0.57	0.199
3/4	0.308	XXS	2.44	6.4	1.050	0.434	0.15	0.001	0.01	0.11	0.27	0.72	0.141
1	0.133	STD - 40	1.68	4.4	1.315	1.049	0.86	0.006	0.04	0.27	0.34	0.49	0.342
1	0.179	XS - 80	2.17	5.7	1.315	0.957	0.72	0.005	0.04	0.25	0.34	0.64	0.312
1	0.250	160	2.84	7.5	1.315	0.815	0.52	0.004	0.03	0.21	0.34	0.84	0.266
1	0.358	XXS	3.66	9.7	1.315	0.599	0.28	0.002	0.01	0.16	0.34	1.08	0.195
1 1/4	0.140	STD - 40	2.27	6.0	1.660	1.380	1.50	0.010	0.08	0.36	0.43	0.67	0.450
1 1/4	0.191	XS - 80	3.00	7.9	1.660	1.278	1.28	0.009	0.07	0.33	0.43	0.88	0.417
1 1/4	0.250	160	3.76	9.9	1.660	1.160	1.06	0.007	0.05	0.30	0.43	1.11	0.378
1 1/4	0.382	XXS	5.21	13.8	1.660	0.896	0.63	0.004	0.03	0.23	0.43	1.53	0.292
1 1/2	0.145	STD - 40	2.72	7.2	1.900	1.610	2.04	0.014	0.11	0.42	0.50	0.80	0.525
1 1/2	0.200	XS - 80	3.63	9.6	1.900	1.500	1.77	0.012	0.09	0.39	0.50	1.07	0.489
1 1/2	0.281	160	4.86	12.8	1.900	1.338	1.41	0.010	0.07	0.35	0.50	1.43	0.436
1 1/2	0.400	XXS	6.41	16.9	1.900	1.100	0.95	0.007	0.05	0.29	0.50	1.88	0.359
2	0.154	STD - 40	3.65	9.6	2.375	2.067	3.36	0.023	0.17	0.54	0.62	1.07	0.674
2	0.218	XS - 80	5.02	13.3	2.375	1.939	2.95	0.021	0.15	0.51	0.62	1.48	0.632
2	0.250		5.67	15.0	2.375	1.875	2.76	0.019	0.14	0.49	0.62	1.67	0.611
2	0.344	160	7.46	19.7	2.375	1.687	2.24	0.016	0.12	0.44	0.62	2.19	0.550
2	0.436	XXS	9.03	23.8	2.375	1.503	1.77	0.012	0.09	0.39	0.62	2.66	0.490
3	0.125		4.51	11.9	3.500	3.250	8.30	0.058	0.43	0.85	0.92	1.33	1.059
3	0.156		5.57	14.7	3.500	3.188	7.98	0.055	0.41	0.83	0.92	1.64	1.039
3	0.188		6.65	17.6	3.500	3.124	7.66	0.053	0.40	0.82	0.92	1.96	1.018
3	0.216	STD - 40	7.58	20.0	3.500	3.068	7.39	0.051	0.38	0.80	0.92	2.23	1.000
3	0.250		8.68	22.9	3.500	3.000	7.07	0.049	0.37	0.79	0.92	2.55	0.978
3	0.281		9.66	25.5	3.500	2.938	6.78	0.047	0.35	0.77	0.92	2.84	0.958
3	0.300	XS - 80	10.25	27.1	3.500	2.900	6.61	0.046	0.34	0.76	0.92	3.02	0.945
3	0.438	160	14.32	37.8	3.500	2.624	5.41	0.038	0.28	0.69	0.92	4.21	0.855
3	0.600	XXS	18.58	49.1	3.500	2.300	4.15	0.029	0.22	0.60	0.92	5.47	0.750
4	0.125		5.84	15.4	4.500	4.250	14.19	0.099	0.74	1.11	1.18	1.72	1.385
4	0.141		6.56	17.3	4.500	4.218	13.97	0.097	0.73	1.10	1.18	1.93	1.375
4	0.156		7.24	19.1	4.500	4.188	13.78	0.096	0.72	1.10	1.18	2.13	1.365
4	0.172		7.95	21.0	4.500	4.156	13.57	0.094	0.70	1.09	1.18	2.34	1.355
4	0.188		8.66	22.9	4.500	4.124	13.36	0.093	0.69	1.08	1.18	2.55	1.344
4	0.203		9.32	24.6	4.500	4.094	13.16	0.091	0.68	1.07	1.18	2.74	1.334
4	0.219		10.01	26.4	4.500	4.062	12.96	0.090	0.67	1.06	1.18	2.95	1.324
4	0.237	STD - 40	10.79	28.5	4.500	4.026	12.73	0.088	0.66	1.05	1.18	3.17	1.312
4	0.250		11.35	30.0	4.500	4.000	12.57	0.087	0.65	1.05	1.18	3.34	1.304
4	0.281		12.66	33.4	4.500	3.938	12.18	0.085	0.63	1.03	1.18	3.72	1.284
4	0.312		13.95	36.8	4.500	3.876	11.80	0.082	0.61	1.01	1.18	4.10	1.263
4	0.337	XS - 80	14.98	39.6	4.500	3.826	11.50	0.080	0.60	1.00	1.18	4.41	1.247
4	0.438	120	19.00	50.2	4.500	3.624	10.31	0.072	0.54	0.95	1.18	5.59	1.181
4	0.500		21.36	56.4	4.500	3.500	9.62	0.067	0.50	0.92	1.18	6.28	1.141
4	0.531	160	22.51	59.4	4.500	3.438	9.28	0.064	0.48	0.90	1.18	6.62	1.121
4	0.674	XXS	27.54	72.7	4.500	3.152	7.80	0.054	0.41	0.83	1.18	8.10	1.027
5	0.156		9.01	23.8	5.563	5.251	21.66	0.150	1.12	1.37	1.46	2.65	1.712
5	0.188		10.79	28.5	5.563	5.187	21.13	0.147	1.10	1.36	1.46	3.17	1.691
5	0.219		12.50	33.0	5.563	5.125	20.63	0.143	1.07	1.34	1.46	3.68	1.670
5	0.258	STD - 40	14.62	38.6	5.563	5.047	20.01	0.139	1.04	1.32	1.46	4.30	1.645
5	0.281		15.85	41.8	5.563	5.001	19.64	0.136	1.02	1.31	1.46	4.66	1.630
5	0.312		17.50	46.2	5.563	4.939	19.16	0.133	1.00	1.29	1.46	5.15	1.610

EXHIBIT A
(2 of 8)

PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	PIPE VOLUME PER FOOT [U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	SURFACE AREA/FT OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
5	0.344		19.17	50.6	5.563	4.875	18.67	0.130	0.97	1.28	1.46	5.64	1.589
5	0.375	XS - 80	20.78	54.9	5.563	4.813	18.19	0.126	0.94	1.26	1.46	6.11	1.569
5	0.500	120	27.04	71.4	5.563	4.563	16.35	0.114	0.85	1.19	1.46	7.95	1.487
5	0.625	160	32.96	87.0	5.563	4.313	14.61	0.101	0.76	1.13	1.46	9.70	1.406
5	0.750	XXS	38.55	101.8	5.563	4.063	12.97	0.090	0.67	1.06	1.46	11.34	1.324
6	0.156		10.78	28.5	6.625	6.313	31.30	0.217	1.63	1.65	1.73	3.17	2.058
6	0.172		11.85	31.3	6.625	6.281	30.98	0.215	1.61	1.64	1.73	3.49	2.047
6	0.188		12.92	34.1	6.625	6.249	30.67	0.213	1.59	1.64	1.73	3.80	2.037
6	0.203		13.92	36.8	6.625	6.219	30.38	0.211	1.58	1.63	1.73	4.10	2.027
6	0.219		14.98	39.6	6.625	6.187	30.06	0.209	1.56	1.62	1.73	4.41	2.017
6	0.250		17.02	44.9	6.625	6.125	29.46	0.205	1.53	1.60	1.73	5.01	1.996
6	0.277		18.78	49.6	6.625	6.071	28.95	0.201	1.50	1.59	1.73	5.52	1.979
6	0.280	STD - 40	18.97	50.1	6.625	6.065	28.89	0.201	1.50	1.59	1.73	5.58	1.977
6	0.312		21.04	55.5	6.625	6.001	28.28	0.196	1.47	1.57	1.73	6.19	1.956
6	0.344		23.08	60.9	6.625	5.937	27.68	0.192	1.44	1.55	1.73	6.79	1.935
6	0.375		25.03	66.1	6.625	5.875	27.11	0.188	1.41	1.54	1.73	7.36	1.915
6	0.432	XS - 80	28.57	75.4	6.625	5.761	26.07	0.181	1.35	1.51	1.73	8.40	1.878
6	0.500		32.71	86.3	6.625	5.625	24.85	0.173	1.29	1.47	1.73	9.62	1.833
6	0.562	120	36.39	96.1	6.625	5.501	23.77	0.165	1.23	1.44	1.73	10.70	1.793
6	0.625		40.05	105.7	6.625	5.375	22.69	0.158	1.18	1.41	1.73	11.78	1.752
6	0.719	160	45.35	119.7	6.625	5.187	21.13	0.147	1.10	1.36	1.73	13.34	1.691
6	0.864	XXS	53.16	140.3	6.625	4.897	18.83	0.131	0.98	1.28	1.73	15.64	1.596
8	0.172		15.53	41.0	8.625	8.281	53.86	0.374	2.80	2.17	2.26	4.57	2.699
8	0.188		16.94	44.7	8.625	8.249	53.44	0.371	2.78	2.16	2.26	4.98	2.689
8	0.203		18.26	48.2	8.625	8.219	53.06	0.368	2.76	2.15	2.26	5.37	2.679
8	0.219		19.66	51.9	8.625	8.187	52.64	0.366	2.73	2.14	2.26	5.78	2.669
8	0.250		22.36	59.0	8.625	8.125	51.85	0.360	2.69	2.13	2.26	6.58	2.648
8	0.277		24.70	65.2	8.625	8.071	51.16	0.355	2.66	2.11	2.26	7.26	2.631
8	0.312		27.70	73.1	8.625	8.001	50.28	0.349	2.61	2.09	2.26	8.15	2.608
8	0.322	STD - 40	28.55	75.4	8.625	7.981	50.03	0.347	2.60	2.09	2.26	8.40	2.601
8	0.344		30.42	80.3	8.625	7.937	49.48	0.344	2.57	2.08	2.26	8.95	2.587
8	0.375		33.04	87.2	8.625	7.875	48.71	0.338	2.53	2.06	2.26	9.72	2.567
8	0.406		35.64	94.1	8.625	7.813	47.94	0.333	2.49	2.05	2.26	10.48	2.547
8	0.438		38.30	101.1	8.625	7.749	47.16	0.328	2.45	2.03	2.26	11.27	2.526
8	0.500	XS - 80	43.39	114.5	8.625	7.625	45.66	0.317	2.37	2.00	2.26	12.76	2.485
8	0.562		48.39	127.8	8.625	7.501	44.19	0.307	2.30	1.96	2.26	14.24	2.445
8	0.594		50.95	134.5	8.625	7.437	43.44	0.302	2.26	1.95	2.26	14.99	2.424
8	0.625		53.40	141.0	8.625	7.375	42.72	0.297	2.22	1.93	2.26	15.71	2.404
8	0.719	120	60.71	160.3	8.625	7.187	40.57	0.282	2.11	1.88	2.26	17.86	2.343
8	0.812		67.75	178.9	8.625	7.001	38.50	0.267	2.00	1.83	2.26	19.93	2.282
8	0.875	XXS	72.42	191.2	8.625	6.875	37.12	0.258	1.93	1.80	2.26	21.30	2.241
8	0.906	160	74.69	197.2	8.625	6.813	36.46	0.253	1.89	1.78	2.26	21.97	2.221
10	0.188		21.21	56.0	10.750	10.374	84.52	0.587	4.39	2.72	2.81	6.24	3.381
10	0.203		22.87	60.4	10.750	10.344	84.04	0.584	4.36	2.71	2.81	6.73	3.372
10	0.219		24.63	65.0	10.750	10.312	83.52	0.580	4.34	2.70	2.81	7.25	3.361
10	0.250		28.03	74.0	10.750	10.250	82.52	0.573	4.29	2.68	2.81	8.25	3.341
10	0.279		31.20	82.4	10.750	10.192	81.58	0.567	4.24	2.67	2.81	9.18	3.322
10	0.307		34.24	90.4	10.750	10.136	80.69	0.560	4.19	2.65	2.81	10.07	3.304
10	0.344		38.23	100.9	10.750	10.062	79.52	0.552	4.13	2.63	2.81	11.25	3.280
10	0.365	STD - 40	40.48	106.9	10.750	10.020	78.85	0.548	4.10	2.62	2.81	11.91	3.266
10	0.438		48.24	127.3	10.750	9.874	76.57	0.532	3.98	2.59	2.81	14.19	3.218
10	0.500	XS	54.73	144.5	10.750	9.750	74.66	0.518	3.88	2.55	2.81	16.10	3.178
10	0.562		61.15	161.4	10.750	9.626	72.77	0.505	3.78	2.52	2.81	17.99	3.138
10	0.594	80	64.43	170.1	10.750	9.562	71.81	0.499	3.73	2.50	2.81	18.95	3.117
10	0.625		67.58	178.4	10.750	9.500	70.88	0.492	3.68	2.49	2.81	19.88	3.096
10	0.719		77.03	203.3	10.750	9.312	68.10	0.473	3.54	2.44	2.81	22.66	3.035
10	0.750		80.10	211.5	10.750	9.250	67.20	0.467	3.49	2.42	2.81	23.56	3.015
10	0.812		86.18	227.5	10.750	9.126	65.41	0.454	3.40	2.39	2.81	25.35	2.975
10	0.844	120	89.29	235.7	10.750	9.062	64.50	0.448	3.35	2.37	2.81	26.27	2.954
10	0.875		92.28	243.6	10.750	9.000	63.62	0.442	3.30	2.36	2.81	27.15	2.934
10	1.000	XXS	104.13	274.9	10.750	8.750	60.13	0.418	3.12	2.29	2.81	30.63	2.852

EXHIBIT A
(3 of 8)

PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	PIPE VOLUME PER FOOT [U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	SURFACE AREA/FT OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
12	0.203		27.20	71.8	12.750	12.344	119.67	0.831	6.22	3.23	3.34	8.00	4.023
12	0.219		29.31	77.4	12.750	12.312	119.05	0.827	6.18	3.22	3.34	8.62	4.013
12	0.250		33.37	88.1	12.750	12.250	117.86	0.818	6.12	3.21	3.34	9.82	3.993
12	0.281		37.42	98.8	12.750	12.188	116.67	0.810	6.06	3.19	3.34	11.01	3.973
12	0.312		41.44	109.4	12.750	12.126	115.48	0.802	6.00	3.17	3.34	12.19	3.952
12	0.330		43.77	115.6	12.750	12.090	114.80	0.797	5.96	3.17	3.34	12.88	3.941
12	0.344		45.58	120.3	12.750	12.062	114.27	0.794	5.94	3.16	3.34	13.41	3.932
12	0.375	STD	49.56	130.8	12.750	12.000	113.10	0.785	5.87	3.14	3.34	14.58	3.911
12	0.406	40	53.52	141.3	12.750	11.938	111.93	0.777	5.81	3.13	3.34	15.74	3.891
12	0.438		57.59	152.0	12.750	11.874	110.73	0.769	5.75	3.11	3.34	16.94	3.870
12	0.500	XS	65.41	172.7	12.750	11.750	108.43	0.753	5.63	3.08	3.34	19.24	3.830
12	0.562		73.15	193.1	12.750	11.626	106.16	0.737	5.51	3.04	3.34	21.52	3.789
12	0.625		80.93	213.7	12.750	11.500	103.87	0.721	5.40	3.01	3.34	23.81	3.748
12	0.688	80	88.63	234.0	12.750	11.374	101.61	0.706	5.28	2.98	3.34	26.07	3.707
12	0.750		96.12	253.8	12.750	11.250	99.40	0.690	5.16	2.95	3.34	28.27	3.667
12	0.844		107.32	283.3	12.750	11.062	96.11	0.667	4.99	2.90	3.34	31.57	3.606
12	0.875		110.97	293.0	12.750	11.000	95.03	0.660	4.94	2.88	3.34	32.64	3.585
12	1.000	XXS - 120	125.49	331.3	12.750	10.750	90.76	0.630	4.71	2.81	3.34	36.91	3.504
14	0.210		30.93	81.6	14.000	13.580	144.84	1.006	7.52	3.56	3.67	9.10	4.426
14	0.219		32.23	85.1	14.000	13.562	144.46	1.003	7.50	3.55	3.67	9.48	4.420
14	0.250		36.71	96.9	14.000	13.500	143.14	0.994	7.43	3.53	3.67	10.80	4.400
14	0.281		41.17	108.7	14.000	13.438	141.83	0.985	7.37	3.52	3.67	12.11	4.380
14	0.312		45.61	120.4	14.000	13.376	140.52	0.976	7.30	3.50	3.67	13.42	4.360
14	0.344		50.17	132.4	14.000	13.312	139.18	0.967	7.23	3.49	3.67	14.76	4.339
14	0.375	STD	54.57	144.1	14.000	13.250	137.89	0.958	7.16	3.47	3.67	16.05	4.319
14	0.438	40	63.44	167.5	14.000	13.124	135.28	0.939	7.03	3.44	3.67	18.66	4.278
14	0.469		67.77	178.9	14.000	13.062	134.00	0.931	6.96	3.42	3.67	19.94	4.257
14	0.500	XS	72.09	190.3	14.000	13.000	132.73	0.922	6.89	3.40	3.67	21.21	4.237
14	0.562		80.66	212.9	14.000	12.876	130.21	0.904	6.76	3.37	3.67	23.73	4.197
14	0.594		85.05	224.5	14.000	12.812	128.92	0.895	6.70	3.35	3.67	25.02	4.176
14	0.625		89.28	235.7	14.000	12.750	127.68	0.887	6.63	3.34	3.67	26.26	4.156
14	0.688		97.81	258.2	14.000	12.624	125.17	0.869	6.50	3.30	3.67	28.77	4.115
14	0.750	80	106.13	280.2	14.000	12.500	122.72	0.852	6.37	3.27	3.67	31.22	4.074
14	0.812		114.37	301.9	14.000	12.376	120.30	0.835	6.25	3.24	3.67	33.64	4.034
16	0.219		36.91	97.4	16.000	15.562	190.20	1.321	9.88	4.07	4.19	10.86	5.072
16	0.250		42.05	111.0	16.000	15.500	188.69	1.310	9.80	4.06	4.19	12.37	5.052
16	0.281		47.17	124.5	16.000	15.438	187.19	1.300	9.72	4.04	4.19	13.88	5.032
16	0.312		52.27	138.0	16.000	15.376	185.68	1.289	9.64	4.03	4.19	15.38	5.012
16	0.344		57.52	151.8	16.000	15.312	184.14	1.279	9.56	4.01	4.19	16.92	4.991
16	0.375	STD	62.58	165.2	16.000	15.250	182.65	1.268	9.49	3.99	4.19	18.41	4.971
16	0.438		72.80	192.2	16.000	15.124	179.65	1.248	9.33	3.96	4.19	21.41	4.930
16	0.469		77.79	205.4	16.000	15.062	178.18	1.237	9.25	3.94	4.19	22.88	4.909
16	0.500	XXS - 40	82.77	218.5	16.000	15.000	176.71	1.227	9.18	3.93	4.19	24.35	4.889
16	0.562		92.66	244.6	16.000	14.876	173.80	1.207	9.03	3.89	4.19	27.26	4.849
16	0.625		102.63	270.9	16.000	14.750	170.87	1.187	8.88	3.86	4.19	30.19	4.808
16	0.656		107.50	283.8	16.000	14.688	169.44	1.177	8.80	3.85	4.19	31.62	4.787
16	0.688		112.51	297.0	16.000	14.624	167.97	1.166	8.72	3.83	4.19	33.10	4.767
16	0.750		122.15	322.5	16.000	14.500	165.13	1.147	8.58	3.80	4.19	35.93	4.726
16	0.812		131.71	347.7	16.000	14.376	162.32	1.127	8.43	3.76	4.19	38.74	4.686
16	0.844	80	136.61	360.7	16.000	14.312	160.88	1.117	8.36	3.75	4.19	40.19	4.665
16	1.000		160.20	422.9	16.000	14.000	153.94	1.069	8.00	3.67	4.19	47.12	4.563
18	0.250		47.39	125.1	18.000	17.500	240.53	1.670	12.49	4.58	4.71	13.94	5.704
18	0.281		53.18	140.4	18.000	17.438	238.83	1.659	12.40	4.57	4.71	15.64	5.684
18	0.312		58.94	155.6	18.000	17.376	237.13	1.647	12.32	4.55	4.71	17.34	5.664
18	0.344		64.87	171.2	18.000	17.312	235.39	1.635	12.23	4.53	4.71	19.08	5.643
18	0.375	STD	70.59	186.3	18.000	17.250	233.71	1.623	12.14	4.52	4.71	20.76	5.623
18	0.406		76.29	201.4	18.000	17.188	232.03	1.611	12.05	4.50	4.71	22.44	5.602
18	0.438		82.15	216.9	18.000	17.124	230.30	1.599	11.96	4.48	4.71	24.17	5.581
18	0.469		87.81	231.8	18.000	17.062	228.64	1.588	11.88	4.47	4.71	25.83	5.561
18	0.500	XS	93.45	246.7	18.000	17.000	226.98	1.576	11.79	4.45	4.71	27.49	5.541

EXHIBIT A
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PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	PIPE VOLUME PER FOOT [U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	SURFACE AREA/FT OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
18	0.562	40	104.66	276.3	18.000	16.876	223.68	1.553	11.62	4.42	4.71	30.79	5.501
18	0.625		115.98	306.2	18.000	16.750	220.35	1.530	11.45	4.39	4.71	34.12	5.460
18	0.688		127.20	335.8	18.000	16.624	217.05	1.507	11.27	4.35	4.71	37.42	5.419
18	0.750		138.17	364.8	18.000	16.500	213.82	1.485	11.11	4.32	4.71	40.64	5.378
18	0.812		149.05	393.5	18.000	16.376	210.62	1.463	10.94	4.29	4.71	43.85	5.338
18	0.938	80	170.92	451.2	18.000	16.124	204.19	1.418	10.61	4.22	4.71	50.28	5.256
18	1.000		181.56	479.3	18.000	16.000	201.06	1.396	10.44	4.19	4.71	53.41	5.215
20	0.250		52.73	139.2	20.000	19.500	298.65	2.074	15.51	5.11	5.24	15.51	6.356
20	0.278		58.55	154.6	20.000	19.444	296.93	2.062	15.42	5.09	5.24	17.22	6.338
20	0.281		59.18	156.2	20.000	19.438	296.75	2.061	15.41	5.09	5.24	17.41	6.336
20	0.312		65.60	173.2	20.000	19.376	294.86	2.048	15.32	5.07	5.24	19.30	6.316
20	0.334		70.15	185.2	20.000	19.332	293.52	2.038	15.25	5.06	5.24	20.64	6.301
20	0.344		72.21	190.6	20.000	19.312	292.92	2.034	15.21	5.06	5.24	21.24	6.295
20	0.347		72.83	192.3	20.000	19.306	292.73	2.033	15.20	5.05	5.24	21.42	6.293
20	0.375	STD	78.60	207.5	20.000	19.250	291.04	2.021	15.12	5.04	5.24	23.12	6.274
20	0.406		84.96	224.3	20.000	19.188	289.17	2.008	15.02	5.02	5.24	24.99	6.254
20	0.417		87.21	230.2	20.000	19.166	288.50	2.004	14.99	5.02	5.24	25.65	6.247
20	0.438		91.51	241.6	20.000	19.124	287.24	1.995	14.92	5.01	5.24	26.92	6.233
20	0.462		96.40	254.5	20.000	19.076	285.80	1.985	14.84	4.99	5.24	28.36	6.218
20	0.469		97.83	258.3	20.000	19.062	285.38	1.982	14.82	4.99	5.24	28.78	6.213
20	0.500	XS	104.13	274.9	20.000	19.000	283.53	1.969	14.73	4.97	5.24	30.63	6.193
20	0.562		116.67	308.0	20.000	18.876	279.84	1.943	14.54	4.94	5.24	34.32	6.153
20	0.594	40	123.11	325.0	20.000	18.812	277.95	1.930	14.44	4.92	5.24	36.21	6.132
20	0.625		129.33	341.4	20.000	18.750	276.12	1.917	14.34	4.91	5.24	38.04	6.111
20	0.688		141.90	374.6	20.000	18.624	272.42	1.892	14.15	4.88	5.24	41.74	6.070
20	0.750		154.19	407.1	20.000	18.500	268.80	1.867	13.96	4.84	5.24	45.36	6.030
20	0.812		166.40	439.3	20.000	18.376	265.21	1.842	13.78	4.81	5.24	48.95	5.990
20	1.000		202.92	535.7	20.000	18.000	254.47	1.767	13.22	4.71	5.24	59.69	5.867
22	0.250		58.07	153.3	22.000	21.500	363.05	2.521	18.86	5.63	5.76	17.08	7.008
22	0.281		65.18	172.1	22.000	21.438	360.96	2.507	18.75	5.61	5.76	19.17	6.988
22	0.312		72.27	190.8	22.000	21.376	358.87	2.492	18.64	5.60	5.76	21.26	6.967
22	0.344		79.56	210.0	22.000	21.312	356.73	2.477	18.53	5.58	5.76	23.40	6.947
22	0.375	STD	86.61	228.6	22.000	21.250	354.66	2.463	18.42	5.56	5.76	25.48	6.926
22	0.438		100.86	266.3	22.000	21.124	350.46	2.434	18.20	5.53	5.76	29.67	6.885
22	0.500	XS	114.81	303.1	22.000	21.000	346.36	2.405	17.99	5.50	5.76	33.77	6.845
22	0.562		128.67	339.7	22.000	20.876	342.28	2.377	17.78	5.47	5.76	37.85	6.804
22	0.625		142.68	376.7	22.000	20.750	338.16	2.348	17.56	5.43	5.76	41.97	6.763
22	0.688		156.59	413.4	22.000	20.624	334.07	2.320	17.35	5.40	5.76	46.06	6.722
22	0.750		170.21	449.4	22.000	20.500	330.06	2.292	17.14	5.37	5.76	50.07	6.682
22	0.812		183.74	485.1	22.000	20.376	326.08	2.264	16.94	5.33	5.76	54.05	6.641
24	0.250		63.41	167.4	24.000	23.500	433.74	3.012	22.53	6.15	6.28	18.65	7.660
24	0.257		65.17	172.0	24.000	23.486	433.22	3.008	22.50	6.15	6.28	19.17	7.655
24	0.278		70.43	185.9	24.000	23.444	431.67	2.998	22.42	6.14	6.28	20.72	7.641
24	0.281		71.18	187.9	24.000	23.438	431.45	2.996	22.41	6.14	6.28	20.94	7.640
24	0.300		75.93	200.5	24.000	23.400	430.05	2.986	22.34	6.13	6.28	22.34	7.627
24	0.312		78.93	208.4	24.000	23.376	429.17	2.980	22.29	6.12	6.28	23.22	7.619
24	0.334		84.42	222.9	24.000	23.332	427.56	2.969	22.21	6.11	6.28	24.83	7.605
24	0.344		86.91	229.4	24.000	23.312	426.82	2.964	22.17	6.10	6.28	25.57	7.598
24	0.370		93.37	246.5	24.000	23.260	424.92	2.951	22.07	6.09	6.28	27.47	7.581
24	0.375	STD	94.62	249.8	24.000	23.250	424.56	2.948	22.05	6.09	6.28	27.83	7.578
24	0.406		102.30	270.1	24.000	23.188	422.30	2.933	21.93	6.07	6.28	30.09	7.558
24	0.420		105.77	279.2	24.000	23.160	421.28	2.926	21.88	6.06	6.28	31.11	7.549
24	0.438		110.22	291.0	24.000	23.124	419.97	2.916	21.81	6.05	6.28	32.42	7.537
24	0.469		117.86	311.2	24.000	23.062	417.72	2.901	21.70	6.04	6.28	34.67	7.517
24	0.500	XS	125.49	331.3	24.000	23.000	415.48	2.885	21.58	6.02	6.28	36.91	7.497
24	0.562		140.68	371.4	24.000	22.876	411.01	2.854	21.35	5.99	6.28	41.38	7.456
24	0.625		156.03	411.9	24.000	22.750	406.49	2.823	21.11	5.96	6.28	45.90	7.415
24	0.688	40	171.29	452.2	24.000	22.624	402.00	2.792	20.88	5.92	6.28	50.39	7.374
24	0.750		186.23	491.6	24.000	22.500	397.61	2.761	20.65	5.89	6.28	54.78	7.334
24	0.812		201.09	530.9	24.000	22.376	393.24	2.731	20.42	5.86	6.28	59.15	7.293
24	1.000		245.64	648.5	24.000	22.000	380.13	2.640	19.74	5.76	6.28	72.26	7.171

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
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EXHIBIT A
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PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	PIPE VOLUME PER FOOT [U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	SURFACE AREA/FT OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
26	0.250		68.75	181.5	26.000	25.500	510.71	3.547	26.53	6.68	6.81	20.22	8.312
26	0.278		76.37	201.6	26.000	25.444	508.46	3.531	26.41	6.66	6.81	22.46	8.293
26	0.281		77.18	203.8	26.000	25.438	508.22	3.529	26.40	6.66	6.81	22.70	8.291
26	0.301		82.61	218.1	26.000	25.398	506.63	3.518	26.31	6.65	6.81	24.30	8.278
26	0.312		85.60	226.0	26.000	25.376	505.75	3.512	26.27	6.64	6.81	25.18	8.271
26	0.334		91.55	241.7	26.000	25.332	504.00	3.500	26.18	6.63	6.81	26.93	8.257
26	0.344		94.26	248.8	26.000	25.312	503.20	3.494	26.14	6.63	6.81	27.73	8.250
26	0.361		98.85	261.0	26.000	25.278	501.85	3.485	26.07	6.62	6.81	29.08	8.239
26	0.375	STD	102.63	270.9	26.000	25.250	500.74	3.477	26.01	6.61	6.81	30.19	8.230
26	0.406		110.98	293.0	26.000	25.188	498.28	3.460	25.88	6.59	6.81	32.64	8.210
26	0.438		119.57	315.7	26.000	25.124	495.76	3.443	25.75	6.58	6.81	35.17	8.189
26	0.469		127.88	337.6	26.000	25.062	493.31	3.426	25.62	6.56	6.81	37.62	8.169
26	0.500	XS	136.17	359.5	26.000	25.000	490.87	3.409	25.50	6.54	6.81	40.06	8.149
26	0.562		152.68	403.1	26.000	24.876	486.02	3.375	25.24	6.51	6.81	44.91	8.108
26	0.625		169.38	447.2	26.000	24.750	481.11	3.341	24.99	6.48	6.81	49.82	8.067
26	0.688		185.99	491.0	26.000	24.624	476.22	3.307	24.74	6.45	6.81	54.71	8.026
26	0.750		202.25	533.9	26.000	24.500	471.44	3.274	24.49	6.41	6.81	59.49	7.986
26	0.875		234.79	619.8	26.000	24.250	461.86	3.207	23.99	6.35	6.81	69.07	7.904
26	1.000		267.00	704.9	26.000	24.000	452.39	3.142	23.50	6.28	6.81	78.54	7.823
28	0.250		74.09	195.6	28.000	27.500	593.96	4.125	30.85	7.20	7.33	21.79	8.963
28	0.281		83.19	219.6	28.000	27.438	591.28	4.106	30.71	7.18	7.33	24.47	8.943
28	0.312		92.26	243.6	28.000	27.376	588.61	4.088	30.57	7.17	7.33	27.14	8.923
28	0.344		101.60	268.2	28.000	27.312	585.86	4.069	30.43	7.15	7.33	29.89	8.902
28	0.375	STD	110.64	292.1	28.000	27.250	583.21	4.050	30.29	7.13	7.33	32.54	8.882
28	0.406		119.65	315.9	28.000	27.188	580.56	4.032	30.15	7.12	7.33	35.20	8.862
28	0.438		128.93	340.4	28.000	27.124	577.83	4.013	30.01	7.10	7.33	37.93	8.841
28	0.469		137.90	364.1	28.000	27.062	575.19	3.994	29.88	7.08	7.33	40.56	8.821
28	0.500	XS	146.85	387.7	28.000	27.000	572.56	3.976	29.74	7.07	7.33	43.20	8.801
28	0.562		164.68	434.8	28.000	26.876	567.31	3.940	29.47	7.04	7.33	48.44	8.760
28	0.625		182.73	482.4	28.000	26.750	562.00	3.903	29.19	7.00	7.33	53.75	8.719
30	0.281		89.19	235.5	30.000	29.438	680.62	4.727	35.35	7.71	7.85	26.24	9.595
30	0.300		95.16	251.2	30.000	29.400	678.87	4.714	35.26	7.70	7.85	27.99	9.583
30	0.312		98.92	261.2	30.000	29.376	677.76	4.707	35.20	7.69	7.85	29.10	9.575
30	0.321		101.75	268.6	30.000	29.358	676.93	4.701	35.16	7.69	7.85	29.93	9.569
30	0.323		102.37	270.3	30.000	29.354	676.74	4.700	35.15	7.68	7.85	30.11	9.568
30	0.325		103.00	271.9	30.000	29.350	676.56	4.698	35.14	7.68	7.85	30.30	9.566
30	0.344		108.95	287.6	30.000	29.312	674.81	4.686	35.05	7.67	7.85	32.05	9.554
30	0.347		109.89	290.1	30.000	29.306	674.53	4.684	35.04	7.67	7.85	32.33	9.552
30	0.360		113.96	300.8	30.000	29.280	673.34	4.676	34.97	7.67	7.85	33.52	9.544
30	0.375	STD	118.65	313.2	30.000	29.250	671.96	4.666	34.90	7.66	7.85	34.90	9.534
30	0.385		121.77	321.5	30.000	29.230	671.04	4.660	34.85	7.65	7.85	35.82	9.527
30	0.400		126.45	333.8	30.000	29.200	669.66	4.650	34.78	7.64	7.85	37.20	9.518
30	0.406		128.32	338.8	30.000	29.188	669.11	4.647	34.75	7.64	7.85	37.75	9.514
30	0.417		131.75	347.8	30.000	29.166	668.10	4.640	34.70	7.64	7.85	38.76	9.507
30	0.420		132.68	350.3	30.000	29.160	667.83	4.638	34.69	7.63	7.85	39.03	9.505
30	0.422		133.30	351.9	30.000	29.156	667.65	4.636	34.68	7.63	7.85	39.21	9.503
30	0.438		138.28	365.1	30.000	29.124	666.18	4.626	34.60	7.62	7.85	40.68	9.493
30	0.469		147.92	390.5	30.000	29.062	663.35	4.607	34.45	7.61	7.85	43.51	9.473
30	0.480		151.33	399.5	30.000	29.040	662.34	4.600	34.40	7.60	7.85	44.52	9.465
30	0.500	XS	157.53	415.9	30.000	29.000	660.52	4.587	34.31	7.59	7.85	46.34	9.452
30	0.504		158.77	419.1	30.000	28.992	660.16	4.584	34.29	7.59	7.85	46.70	9.450
30	0.525		165.26	436.3	30.000	28.950	658.24	4.571	34.19	7.58	7.85	48.61	9.436
30	0.530		166.81	440.4	30.000	28.940	657.79	4.568	34.17	7.58	7.85	49.07	9.433
30	0.562		176.69	466.5	30.000	28.876	654.88	4.548	34.01	7.56	7.85	51.97	9.412
30	0.563		177.00	467.3	30.000	28.874	654.79	4.547	34.01	7.56	7.85	52.07	9.411
30	0.625		196.08	517.6	30.000	28.750	649.18	4.508	33.72	7.53	7.85	57.68	9.371
30	0.750		234.29	618.5	30.000	28.500	637.94	4.430	33.13	7.46	7.85	68.92	9.289
30	0.875		272.17	718.5	30.000	28.250	626.80	4.353	32.56	7.40	7.85	80.06	9.208
30	1.000		309.72	817.6	30.000	28.000	615.75	4.276	31.98	7.33	7.85	91.11	9.126
30.2	0.423		134.52	355.1	30.200	29.354	676.74	4.700	35.15	7.68	7.91	39.57	9.568

EXHIBIT A
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PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	[U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
32	0.250		84.77	223.8	32.000	31.500	779.31	5.412	40.48	8.25	8.38	24.94	10.267
32	0.281		95.19	251.3	32.000	31.438	776.25	5.391	40.32	8.23	8.38	28.00	10.247
32	0.312		105.59	278.8	32.000	31.376	773.19	5.369	40.16	8.21	8.38	31.06	10.227
32	0.344		116.30	307.0	32.000	31.312	770.04	5.347	40.00	8.20	8.38	34.21	10.206
32	0.375	STD	126.66	334.4	32.000	31.250	766.99	5.326	39.84	8.18	8.38	37.26	10.186
32	0.406		136.99	361.7	32.000	31.188	763.95	5.305	39.68	8.16	8.38	40.30	10.166
32	0.438		147.64	389.8	32.000	31.124	760.82	5.283	39.52	8.15	8.38	43.43	10.145
32	0.469		157.93	416.9	32.000	31.062	757.79	5.262	39.36	8.13	8.38	46.46	10.125
32	0.500	XS	168.21	444.1	32.000	31.000	754.77	5.241	39.20	8.12	8.38	49.48	10.104
32	0.562		188.69	498.1	32.000	30.876	748.74	5.200	38.89	8.08	8.38	55.51	10.064
32	0.625		209.43	552.9	32.000	30.750	742.64	5.157	38.57	8.05	8.38	61.60	10.023
34	0.250		90.11	237.9	34.000	33.500	881.41	6.121	45.78	8.77	8.90	26.51	10.919
34	0.281		101.19	267.1	34.000	33.438	878.15	6.098	45.61	8.75	8.90	29.77	10.899
34	0.312		112.25	296.3	34.000	33.376	874.90	6.076	45.44	8.74	8.90	33.02	10.879
34	0.344		123.65	326.4	34.000	33.312	871.55	6.052	45.27	8.72	8.90	36.37	10.858
34	0.375	STD	134.67	355.5	34.000	33.250	868.31	6.030	45.10	8.70	8.90	39.61	10.838
34	0.406		145.66	384.6	34.000	33.188	865.07	6.007	44.93	8.69	8.90	42.85	10.817
34	0.438		157.00	414.5	34.000	33.124	861.74	5.984	44.76	8.67	8.90	46.18	10.797
34	0.469		167.95	443.4	34.000	33.062	858.52	5.962	44.59	8.66	8.90	49.40	10.776
34	0.500	XS	178.89	472.3	34.000	33.000	855.30	5.940	44.42	8.64	8.90	52.62	10.756
34	0.562		200.70	529.8	34.000	32.876	848.88	5.895	44.09	8.61	8.90	59.04	10.716
34	0.625		222.77	588.1	34.000	32.750	842.39	5.850	43.75	8.57	8.90	65.53	10.675
36	0.312		118.92	313.9	36.000	35.376	982.90	6.826	51.05	9.26	9.42	34.98	11.531
36	0.344		131.00	345.8	36.000	35.312	979.34	6.801	50.87	9.24	9.42	38.53	11.510
36	0.356		135.52	357.8	36.000	35.288	978.01	6.792	50.80	9.24	9.42	39.86	11.502
36	0.375	STD	142.68	376.7	36.000	35.250	975.91	6.777	50.69	9.23	9.42	41.97	11.490
36	0.385		146.44	386.6	36.000	35.230	974.80	6.769	50.63	9.22	9.42	43.08	11.483
36	0.388		147.57	389.6	36.000	35.224	974.47	6.767	50.61	9.22	9.42	43.41	11.481
36	0.406		154.34	407.4	36.000	35.188	972.48	6.753	50.51	9.21	9.42	45.40	11.469
36	0.417		158.47	418.4	36.000	35.166	971.26	6.745	50.45	9.21	9.42	46.62	11.462
36	0.438		166.35	439.2	36.000	35.124	968.94	6.729	50.33	9.20	9.42	48.93	11.449
36	0.450		170.85	451.0	36.000	35.100	967.62	6.720	50.26	9.19	9.42	50.26	11.441
36	0.469		177.97	469.8	36.000	35.062	965.52	6.705	50.15	9.18	9.42	52.35	11.428
36	0.500	XS	189.57	500.5	36.000	35.000	962.11	6.681	49.97	9.16	9.42	55.76	11.408
36	0.504		191.06	504.4	36.000	34.992	961.67	6.678	49.95	9.16	9.42	56.20	11.405
36	0.525		198.91	525.1	36.000	34.950	959.37	6.662	49.83	9.15	9.42	58.51	11.392
36	0.540		204.50	539.9	36.000	34.920	957.72	6.651	49.74	9.14	9.42	60.16	11.382
36	0.562		212.70	561.5	36.000	34.876	955.31	6.634	49.62	9.13	9.42	62.57	11.368
36	0.600		226.84	598.9	36.000	34.800	951.15	6.605	49.40	9.11	9.42	66.73	11.343
36	0.605		228.70	603.8	36.000	34.790	950.60	6.601	49.37	9.11	9.42	67.27	11.340
36	0.625		236.12	623.4	36.000	34.750	948.42	6.586	49.26	9.10	9.42	69.46	11.327
36	0.660		249.10	657.6	36.000	34.680	944.60	6.560	49.06	9.08	9.42	73.28	11.304
36	0.688		259.46	685.0	36.000	34.624	941.55	6.539	48.90	9.06	9.42	76.32	11.286
36	0.750		282.35	745.4	36.000	34.500	934.82	6.492	48.56	9.03	9.42	83.06	11.245
36	0.875		328.24	866.5	36.000	34.250	921.32	6.398	47.85	8.97	9.42	96.55	11.164
36	1.000		373.79	986.8	36.000	34.000	907.92	6.305	47.16	8.90	9.42	109.96	11.082
36.24	0.508		193.86	511.8	36.240	35.224	974.47	6.767	50.61	9.22	9.49	57.03	11.481
38	0.312		125.58	331.5	38.000	37.376	1097.17	7.619	56.99	9.79	9.95	36.94	12.183
38	0.344		138.34	365.2	38.000	37.312	1093.42	7.593	56.79	9.77	9.95	40.70	12.162
38	0.375	STD	150.69	397.8	38.000	37.250	1089.79	7.568	56.60	9.75	9.95	44.33	12.141
38	0.406		163.01	430.3	38.000	37.188	1086.16	7.543	56.42	9.74	9.95	47.95	12.121
38	0.438		175.71	463.9	38.000	37.124	1082.43	7.517	56.22	9.72	9.95	51.69	12.100
38	0.469		187.99	496.3	38.000	37.062	1078.82	7.492	56.03	9.70	9.95	55.30	12.080
38	0.500	XS	200.25	528.7	38.000	37.000	1075.21	7.467	55.85	9.69	9.95	58.90	12.060
38	0.562		224.71	593.2	38.000	36.876	1068.02	7.417	55.47	9.65	9.95	66.10	12.020
38	0.625		249.47	658.6	38.000	36.750	1060.73	7.366	55.09	9.62	9.95	73.39	11.978
40	0.344		145.69	384.6	40.000	39.312	1213.78	8.429	63.04	10.29	10.47	42.86	12.814
40	0.375	STD	158.70	419.0	40.000	39.250	1209.95	8.402	62.85	10.28	10.47	46.68	12.793

EXHIBIT A
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PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	[U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
40	0.406		171.68	453.2	40.000	39.188	1206.14	8.376	62.65	10.26	10.47	50.50	12.773
40	0.438		185.06	488.6	40.000	39.124	1202.20	8.349	62.44	10.24	10.47	54.44	12.752
40	0.469		198.00	522.7	40.000	39.062	1198.39	8.322	62.25	10.23	10.47	58.25	12.732
40	0.500	XS	210.93	556.8	40.000	39.000	1194.59	8.296	62.05	10.21	10.47	62.05	12.712
40	0.562		236.71	624.9	40.000	38.876	1187.01	8.243	61.65	10.18	10.47	69.63	12.671
40	0.625		262.82	693.9	40.000	38.750	1179.32	8.190	61.25	10.14	10.47	77.31	12.630
42	0.312		138.91	366.7	42.000	41.376	1344.58	9.337	69.84	10.83	11.00	40.86	13.486
42	0.323		143.77	379.5	42.000	41.354	1343.15	9.327	69.76	10.83	11.00	42.29	13.479
42	0.344		153.04	404.0	42.000	41.312	1340.42	9.309	69.62	10.82	11.00	45.02	13.465
42	0.363		161.42	426.1	42.000	41.274	1337.96	9.291	69.49	10.81	11.00	47.48	13.453
42	0.375	STD	166.71	440.1	42.000	41.250	1336.40	9.281	69.41	10.80	11.00	49.04	13.445
42	0.406		180.35	476.1	42.000	41.188	1332.39	9.253	69.20	10.78	11.00	53.05	13.425
42	0.417		185.19	488.9	42.000	41.166	1330.97	9.243	69.13	10.78	11.00	54.48	13.418
42	0.438		194.42	513.3	42.000	41.124	1328.25	9.224	68.99	10.77	11.00	57.19	13.404
42	0.450		199.69	527.2	42.000	41.100	1326.70	9.213	68.91	10.76	11.00	58.74	13.396
42	0.469		208.02	549.2	42.000	41.062	1324.25	9.196	68.78	10.75	11.00	61.19	13.384
42	0.486		215.47	568.9	42.000	41.028	1322.06	9.181	68.67	10.74	11.00	63.38	13.373
42	0.500	XS	221.61	585.0	42.000	41.000	1320.25	9.168	68.57	10.73	11.00	65.19	13.364
42	0.562		248.71	656.6	42.000	40.876	1312.28	9.113	68.16	10.70	11.00	73.16	13.323
42	0.625		276.17	729.1	42.000	40.750	1304.20	9.057	67.74	10.67	11.00	81.24	13.282
42	0.688		303.55	801.4	42.000	40.624	1296.15	9.001	67.32	10.64	11.00	89.29	13.241
42	0.750		330.41	872.3	42.000	40.500	1288.25	8.946	66.91	10.60	11.00	97.19	13.201
42	0.812		357.18	943.0	42.000	40.376	1280.37	8.891	66.50	10.57	11.00	105.07	13.160
42	0.875		384.31	1014.6	42.000	40.250	1272.39	8.836	66.09	10.54	11.00	113.05	13.119
42	1.000		437.87	1156.0	42.000	40.000	1256.64	8.727	65.27	10.47	11.00	128.81	13.038
44	0.312		145.57	384.3	44.000	43.376	1477.71	10.262	76.75	11.36	11.52	42.82	14.138
44	0.334		155.76	411.2	44.000	43.332	1474.71	10.241	76.60	11.34	11.52	45.82	14.124
44	0.344		160.39	423.4	44.000	43.312	1473.35	10.232	76.53	11.34	11.52	47.18	14.117
44	0.370		172.41	455.2	44.000	43.260	1469.82	10.207	76.34	11.33	11.52	50.72	14.100
44	0.375	STD	174.72	461.2	44.000	43.250	1469.14	10.202	76.31	11.32	11.52	51.39	14.097
44	0.406		189.02	499.0	44.000	43.188	1464.93	10.173	76.09	11.31	11.52	55.60	14.077
44	0.417		194.10	512.4	44.000	43.166	1463.44	10.163	76.01	11.30	11.52	57.10	14.070
44	0.438		203.77	538.0	44.000	43.124	1460.59	10.143	75.86	11.29	11.52	59.94	14.056
44	0.469		218.04	575.6	44.000	43.062	1456.39	10.114	75.65	11.27	11.52	64.14	14.036
44	0.476		221.26	584.1	44.000	43.048	1455.45	10.107	75.60	11.27	11.52	65.09	14.031
44	0.500	XS	232.29	613.2	44.000	43.000	1452.20	10.085	75.43	11.26	11.52	68.33	14.016
44	0.513		238.25	629.0	44.000	42.974	1450.45	10.073	75.34	11.25	11.52	70.09	14.007
44	0.556		257.97	681.0	44.000	42.888	1444.65	10.032	75.04	11.23	11.52	75.88	13.979
44	0.562		260.72	688.3	44.000	42.876	1443.84	10.027	74.99	11.22	11.52	76.69	13.975
44	0.625		289.52	764.3	44.000	42.750	1435.36	9.968	74.55	11.19	11.52	85.17	13.934
44	0.688		318.25	840.2	44.000	42.624	1426.92	9.909	74.11	11.16	11.52	93.62	13.893
44	0.750		346.43	914.6	44.000	42.500	1418.63	9.852	73.68	11.13	11.52	101.91	13.853
44	0.812		374.53	988.8	44.000	42.376	1410.36	9.794	73.25	11.09	11.52	110.17	13.812
44	0.875		403.00	1063.9	44.000	42.250	1401.98	9.736	72.82	11.06	11.52	118.55	13.771
44	1.000		459.23	1212.4	44.000	42.000	1385.44	9.621	71.96	11.00	11.52	135.09	13.690
46	0.312		152.24	401.9	46.000	45.376	1617.12	11.230	83.99	11.88	12.04	44.78	14.790
46	0.334		162.89	430.0	46.000	45.332	1613.99	11.208	83.83	11.87	12.04	47.92	14.776
46	0.344		167.73	442.8	46.000	45.312	1612.56	11.198	83.76	11.86	12.04	49.34	14.769
46	0.370		180.31	476.0	46.000	45.260	1608.86	11.173	83.57	11.85	12.04	53.04	14.752
46	0.375	STD	182.73	482.4	46.000	45.250	1608.15	11.168	83.53	11.85	12.04	53.75	14.749
46	0.406		197.70	521.9	46.000	45.188	1603.75	11.137	83.30	11.83	12.04	58.15	14.729
46	0.417		203.00	535.9	46.000	45.166	1602.19	11.126	83.22	11.82	12.04	59.72	14.722
46	0.438		213.13	562.7	46.000	45.124	1599.21	11.106	83.06	11.81	12.04	62.69	14.708
46	0.469		228.06	602.1	46.000	45.062	1594.82	11.075	82.84	11.80	12.04	67.09	14.688
46	0.476		231.43	611.0	46.000	45.048	1593.83	11.068	82.78	11.79	12.04	68.08	14.683
46	0.500	XS	242.97	641.4	46.000	45.000	1590.43	11.045	82.61	11.78	12.04	71.47	14.668
46	0.513		249.21	657.9	46.000	44.974	1588.59	11.032	82.51	11.77	12.04	73.31	14.659
46	0.556		269.85	712.4	46.000	44.888	1582.52	10.990	82.20	11.75	12.04	79.38	14.631
46	0.562		272.72	720.0	46.000	44.876	1581.68	10.984	82.15	11.75	12.04	80.22	14.627
46	0.625		302.87	799.6	46.000	44.750	1572.81	10.922	81.69	11.72	12.04	89.09	14.586
46	0.688		332.94	879.0	46.000	44.624	1563.96	10.861	81.23	11.68	12.04	97.94	14.545

EXHIBIT A
(8 of 8)

PROPERTIES OF PIPE

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	WT PER MILE [TONS]	OD [IN]	ID [IN]	TRANS-VERSE AREA [SQ IN]	PIPE VOLUME PER FOOT [CU FT]	PIPE VOLUME PER FOOT [U.S. GAL]	SURFACE AREA/FT ID [SQ FT]	SURFACE AREA/FT OD [SQ FT]	METAL CROSS SECTION [SQ IN]	EQUIV 3 IN FACTOR
46	0.750		362.45	956.9	46.000	44.500	1555.28	10.801	80.78	11.65	12.04	106.62	14.505
46	0.812		391.87	1034.5	46.000	44.376	1546.63	10.740	80.33	11.62	12.04	115.27	14.464
46	0.875		421.69	1113.3	46.000	44.250	1537.86	10.680	79.88	11.58	12.04	124.04	14.423
46	1.000		480.59	1268.8	46.000	44.000	1520.53	10.559	78.98	11.52	12.04	141.37	14.342
48	0.312		158.90	419.5	48.000	47.376	1762.81	12.242	91.56	12.40	12.57	46.74	15.442
48	0.334		170.03	448.9	48.000	47.332	1759.54	12.219	91.39	12.39	12.57	50.02	15.428
48	0.344		175.08	462.2	48.000	47.312	1758.06	12.209	91.31	12.39	12.57	51.50	15.421
48	0.370		188.21	496.9	48.000	47.260	1754.19	12.182	91.11	12.37	12.57	55.36	15.404
48	0.375	STD	190.74	503.5	48.000	47.250	1753.45	12.177	91.08	12.37	12.57	56.11	15.401
48	0.406		206.37	544.8	48.000	47.188	1748.85	12.145	90.84	12.35	12.57	60.71	15.381
48	0.417		211.91	559.4	48.000	47.166	1747.22	12.133	90.75	12.35	12.57	62.34	15.374
48	0.438		222.48	587.4	48.000	47.124	1744.11	12.112	90.59	12.34	12.57	65.45	15.360
48	0.469		238.08	628.5	48.000	47.062	1739.52	12.080	90.35	12.32	12.57	70.03	15.340
48	0.476		241.59	637.8	48.000	47.048	1738.49	12.073	90.30	12.32	12.57	71.07	15.335
48	0.500	XS	253.65	669.6	48.000	47.000	1734.94	12.048	90.11	12.30	12.57	74.61	15.319
48	0.513		260.17	686.8	48.000	46.974	1733.03	12.035	90.01	12.30	12.57	76.53	15.311
48	0.556		281.72	743.7	48.000	46.888	1726.69	11.991	89.68	12.28	12.57	82.87	15.283
48	0.562		284.73	751.7	48.000	46.876	1725.80	11.985	89.64	12.27	12.57	83.76	15.279
48	0.625		316.22	834.8	48.000	46.750	1716.54	11.920	89.16	12.24	12.57	93.02	15.238
48	0.688		347.64	917.8	48.000	46.624	1707.30	11.856	88.68	12.21	12.57	102.26	15.197
48	0.750		378.47	999.2	48.000	46.500	1698.23	11.793	88.21	12.17	12.57	111.33	15.156
48	0.812		409.22	1080.3	48.000	46.376	1689.18	11.730	87.74	12.14	12.57	120.38	15.116
48	0.875		440.38	1162.6	48.000	46.250	1680.02	11.667	87.26	12.11	12.57	129.54	15.075
48	1.000		501.95	1325.2	48.000	46.000	1661.90	11.541	86.32	12.04	12.57	147.65	14.993

EXHIBIT B
(1 of 72)

YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
1/2	0.109	STD - 40	0.85	6851	6229	5606	4485	3737	3114	2491	1869	1246
1/2	0.147	XS - 80	1.09	9240	8400	7560	6048	5040	4200	3360	2520	1680
1/2	0.188	160	1.31	11817	10743	9669	7735	6446	5371	4297	3223	2149
1/2	0.294	XXS	1.71	18480	16800	15120	12096	10080	8400	6720	5040	3360
3/4	0.113	STD - 40	1.13	5682	5166	4649	3719	3099	2583	2066	1550	1033
3/4	0.154	XS - 80	1.47	7744	7040	6336	5069	4224	3520	2816	2112	1408
3/4	0.219	160	1.94	11013	10011	9010	7208	6007	5006	4005	3003	2002
3/4	0.308	XXS	2.44	15488	14080	12672	10138	8448	7040	5632	4224	2816
1	0.133	STD - 40	1.68	5340	4855	4369	3495	2913	2427	1942	1456	971
1	0.179	XS - 80	2.17	7187	6534	5880	4704	3920	3267	2614	1960	1307
1	0.250	160	2.84	10038	9125	8213	6570	5475	4563	3650	2738	1825
1	0.358	XXS	3.66	14374	13068	11761	9409	7841	6534	5227	3920	2614
1 1/4	0.140	STD - 40	2.27	4453	4048	3643	2915	2429	2024	1619	1214	810
1 1/4	0.191	XS - 80	3.00	6075	5523	4971	3976	3314	2761	2209	1657	1105
1 1/4	0.250	160	3.76	7952	7229	6506	5205	4337	3614	2892	2169	1446
1 1/4	0.382	XXS	5.21	12150	11046	9941	7953	6627	5523	4418	3314	2209
1 1/2	0.145	STD - 40	2.72	4029	3663	3297	2637	2198	1832	1465	1099	733
1 1/2	0.200	XS - 80	3.63	5558	5053	4547	3638	3032	2526	2021	1516	1011
1 1/2	0.281	160	4.86	7809	7099	6389	5111	4259	3549	2840	2130	1420
1 1/2	0.400	XXS	6.41	11116	10105	9095	7276	6063	5053	4042	3032	2021
2	0.154	STD - 40	3.65	3424	3112	2801	2241	1867	1556	1245	934	622
2	0.218	XS - 80	5.02	4846	4406	3965	3172	2644	2203	1762	1322	881
2	0.250		5.67	5558	5053	4547	3638	3032	2526	2021	1516	1011
2	0.344	160	7.46	7648	6952	6257	5006	4171	3476	2781	2086	1390
2	0.436	XXS	9.03	9693	8812	7931	6344	5287	4406	3525	2644	1762
3	0.125		4.51	1886	1714	1543	1234	1029	857	686	514	343
3	0.156		5.57	2353	2139	1925	1540	1284	1070	856	642	428
3	0.188		6.65	2836	2578	2320	1856	1547	1289	1031	773	516
3	0.216	STD - 40	7.58	3259	2962	2666	2133	1777	1481	1185	889	592
3	0.250		8.68	3771	3429	3086	2469	2057	1714	1371	1029	686
3	0.281		9.66	4239	3854	3468	2775	2312	1927	1541	1156	771
3	0.300	XS - 80	10.25	4526	4114	3703	2962	2469	2057	1646	1234	823
3	0.438	160	14.32	6608	6007	5406	4325	3604	3003	2403	1802	1201
3	0.600	XXS	18.58	9051	8229	7406	5925	4937	4114	3291	2469	1646
4	0.125		5.84	1467	1333	1200	960	800	667	533	400	267
4	0.141		6.56	1654	1504	1354	1083	902	752	602	451	301
4	0.156		7.24	1830	1664	1498	1198	998	832	666	499	333
4	0.172		7.95	2018	1835	1651	1321	1101	917	734	550	367
4	0.188		8.66	2206	2005	1805	1444	1203	1003	802	602	401
4	0.203		9.32	2382	2165	1949	1559	1299	1083	866	650	433
4	0.219		10.01	2570	2336	2102	1682	1402	1168	934	701	467
4	0.237	STD - 40	10.79	2781	2528	2275	1820	1517	1264	1011	758	506
4	0.250		11.35	2933	2667	2400	1920	1600	1333	1067	800	533
4	0.281		12.66	3297	2997	2698	2158	1798	1499	1199	899	599
4	0.312		13.95	3661	3328	2995	2396	1997	1664	1331	998	666
4	0.337	XS - 80	14.98	3954	3595	3235	2588	2157	1797	1438	1078	719
4	0.438	120	19.00	5139	4672	4205	3364	2803	2336	1869	1402	934
4	0.500		21.36	5867	5333	4800	3840	3200	2667	2133	1600	1067
4	0.531	160	22.51	6230	5664	5098	4078	3398	2832	2266	1699	1133
4	0.674	XXS	27.54	7908	7189	6470	5176	4314	3595	2876	2157	1438
5	0.156		9.01	1481	1346	1211	969	808	673	538	404	269
5	0.188		10.79	1784	1622	1460	1168	973	811	649	487	324
5	0.219		12.50	2079	1890	1701	1361	1134	945	756	567	378

EXHIBIT B
(2 of 72)

YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
5	0.258	STD - 40	14.62	2449	2226	2004	1603	1336	1113	890	668	445
5	0.281		15.85	2667	2425	2182	1746	1455	1212	970	727	485
5	0.312		17.50	2961	2692	2423	1938	1615	1346	1077	808	538
5	0.344		19.17	3265	2968	2671	2137	1781	1484	1187	890	594
5	0.375	XS - 80	20.78	3559	3236	2912	2330	1941	1618	1294	971	647
5	0.500	120	27.04	4746	4314	3883	3106	2589	2157	1726	1294	863
5	0.625	160	32.96	5932	5393	4853	3883	3236	2696	2157	1618	1079
5	0.750	XXS	38.55	7118	6471	5824	4659	3883	3236	2589	1941	1294
6	0.156		10.78	1243	1130	1017	814	678	565	452	339	226
6	0.172		11.85	1371	1246	1122	897	748	623	498	374	249
6	0.188		12.92	1498	1362	1226	981	817	681	545	409	272
6	0.203		13.92	1618	1471	1324	1059	882	735	588	441	294
6	0.219		14.98	1745	1587	1428	1142	952	793	635	476	317
6	0.250		17.02	1992	1811	1630	1304	1087	906	725	543	362
6	0.277		18.78	2208	2007	1806	1445	1204	1003	803	602	401
6	0.280	STD - 40	18.97	2232	2029	1826	1461	1217	1014	811	609	406
6	0.312		21.04	2487	2261	2034	1628	1356	1130	904	678	452
6	0.344		23.08	2742	2492	2243	1795	1495	1246	997	748	498
6	0.375		25.03	2989	2717	2445	1956	1630	1358	1087	815	543
6	0.432	XS - 80	28.57	3443	3130	2817	2254	1878	1565	1252	939	626
6	0.500		32.71	3985	3623	3260	2608	2174	1811	1449	1087	725
6	0.562	120	36.39	4479	4072	3665	2932	2443	2036	1629	1222	814
6	0.625		40.05	4981	4528	4075	3260	2717	2264	1811	1358	906
6	0.719	160	45.35	5730	5209	4688	3751	3126	2605	2084	1563	1042
6	0.864	XXS	53.16	6886	6260	5634	4507	3756	3130	2504	1878	1252
8	0.172		15.53	1053	957	861	689	574	479	383	287	191
8	0.188		16.94	1151	1046	942	753	628	523	419	314	209
8	0.203		18.26	1243	1130	1017	813	678	565	452	339	226
8	0.219		19.66	1341	1219	1097	878	731	609	488	366	244
8	0.250		22.36	1530	1391	1252	1002	835	696	557	417	278
8	0.277		24.70	1696	1542	1387	1110	925	771	617	462	308
8	0.312		27.70	1910	1736	1563	1250	1042	868	695	521	347
8	0.322	STD - 40	28.55	1971	1792	1613	1290	1075	896	717	538	358
8	0.344		30.42	2106	1914	1723	1378	1149	957	766	574	383
8	0.375		33.04	2296	2087	1878	1503	1252	1043	835	626	417
8	0.406		35.64	2485	2259	2034	1627	1356	1130	904	678	452
8	0.438		38.30	2681	2438	2194	1755	1463	1219	975	731	488
8	0.500	XS - 80	43.39	3061	2783	2504	2003	1670	1391	1113	835	557
8	0.562		48.39	3440	3128	2815	2252	1877	1564	1251	938	626
8	0.594		50.95	3636	3306	2975	2380	1983	1653	1322	992	661
8	0.625		53.40	3826	3478	3130	2504	2087	1739	1391	1043	696
8	0.719	120	60.71	4402	4001	3601	2881	2401	2001	1601	1200	800
8	0.812		67.75	4971	4519	4067	3254	2711	2259	1808	1356	904
8	0.875	XXS	72.42	5357	4870	4383	3506	2922	2435	1948	1461	974
8	0.906	160	74.69	5546	5042	4538	3630	3025	2521	2017	1513	1008
10	0.188		21.21	923	839	755	604	504	420	336	252	168
10	0.203		22.87	997	906	816	653	544	453	363	272	181
10	0.219		24.63	1076	978	880	704	587	489	391	293	196
10	0.250		28.03	1228	1116	1005	804	670	558	447	335	223
10	0.279		31.20	1370	1246	1121	897	747	623	498	374	249
10	0.307		34.24	1508	1371	1234	987	822	685	548	411	274
10	0.344		38.23	1690	1536	1382	1106	922	768	614	461	307
10	0.365	STD - 40	40.48	1793	1630	1467	1173	978	815	652	489	326
10	0.438		48.24	2151	1956	1760	1408	1173	978	782	587	391
10	0.500	XS	54.73	2456	2233	2009	1607	1340	1116	893	670	447
10	0.562		61.15	2760	2509	2258	1807	1506	1255	1004	753	502
10	0.594	80	64.43	2918	2652	2387	1910	1591	1326	1061	796	530
10	0.625		67.58	3070	2791	2512	2009	1674	1395	1116	837	558

EXHIBIT B
(3 of 72)

YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
10	0.719		77.03	3531	3210	2889	2312	1926	1605	1284	963	642
10	0.750		80.10	3684	3349	3014	2411	2009	1674	1340	1005	670
10	0.812		86.18	3988	3626	3263	2610	2175	1813	1450	1088	725
10	0.844	120	89.29	4145	3769	3392	2713	2261	1884	1507	1131	754
10	0.875		92.28	4298	3907	3516	2813	2344	1953	1563	1172	781
10	1.000	XXS	104.13	4912	4465	4019	3215	2679	2233	1786	1340	893
12	0.203		27.20	841	764	688	550	459	382	306	229	153
12	0.219		29.31	907	824	742	594	495	412	330	247	165
12	0.250		33.37	1035	941	847	678	565	471	376	282	188
12	0.281		37.42	1164	1058	952	762	635	529	423	317	212
12	0.312		41.44	1292	1175	1057	846	705	587	470	352	235
12	0.330		43.77	1367	1242	1118	894	745	621	497	373	248
12	0.344		45.58	1425	1295	1166	932	777	648	518	389	259
12	0.375	STD	49.56	1553	1412	1271	1016	847	706	565	424	282
12	0.406	40	53.52	1681	1528	1376	1100	917	764	611	459	306
12	0.438		57.59	1814	1649	1484	1187	989	824	660	495	330
12	0.500	XS	65.41	2071	1882	1694	1355	1129	941	753	565	376
12	0.562		73.15	2327	2116	1904	1523	1269	1058	846	635	423
12	0.625		80.93	2588	2353	2118	1694	1412	1176	941	706	471
12	0.688	80	88.63	2849	2590	2331	1865	1554	1295	1036	777	518
12	0.750		96.12	3106	2824	2541	2033	1694	1412	1129	847	565
12	0.844		107.32	3495	3177	2860	2288	1906	1589	1271	953	635
12	0.875		110.97	3624	3294	2965	2372	1976	1647	1318	988	659
12	1.000	XXS - 120	125.49	4141	3765	3388	2711	2259	1882	1506	1129	753
14	0.210		30.93	792	720	648	518	432	360	288	216	144
14	0.219		32.23	826	751	676	541	451	375	300	225	150
14	0.250		36.71	943	857	771	617	514	429	343	257	171
14	0.281		41.17	1060	963	867	694	578	482	385	289	193
14	0.312		45.61	1177	1070	963	770	642	535	428	321	214
14	0.344		50.17	1297	1179	1061	849	708	590	472	354	236
14	0.375	STD	54.57	1414	1286	1157	926	771	643	514	386	257
14	0.438	40	63.44	1652	1502	1352	1081	901	751	601	451	300
14	0.469		67.77	1769	1608	1447	1158	965	804	643	482	322
14	0.500	XS	72.09	1886	1714	1543	1234	1029	857	686	514	343
14	0.562		80.66	2120	1927	1734	1387	1156	963	771	578	385
14	0.594		85.05	2240	2037	1833	1466	1222	1018	815	611	407
14	0.625		89.28	2357	2143	1929	1543	1286	1071	857	643	429
14	0.688		97.81	2595	2359	2123	1698	1415	1179	944	708	472
14	0.750	80	106.13	2829	2571	2314	1851	1543	1286	1029	771	514
14	0.812		114.37	3062	2784	2506	2004	1670	1392	1114	835	557
16	0.219		36.91	723	657	591	473	394	329	263	197	131
16	0.250		42.05	825	750	675	540	450	375	300	225	150
16	0.281		47.17	927	843	759	607	506	422	337	253	169
16	0.312		52.27	1030	936	842	674	562	468	374	281	187
16	0.344		57.52	1135	1032	929	743	619	516	413	310	206
16	0.375	STD	62.58	1238	1125	1013	810	675	563	450	338	225
16	0.438		72.80	1445	1314	1183	946	788	657	526	394	263
16	0.469		77.79	1548	1407	1266	1013	844	704	563	422	281
16	0.500	XXS - 40	82.77	1650	1500	1350	1080	900	750	600	450	300
16	0.562		92.66	1855	1686	1517	1214	1012	843	674	506	337
16	0.625		102.63	2063	1875	1688	1350	1125	938	750	563	375
16	0.656		107.50	2165	1968	1771	1417	1181	984	787	590	394
16	0.688		112.51	2270	2064	1858	1486	1238	1032	826	619	413
16	0.750		122.15	2475	2250	2025	1620	1350	1125	900	675	450
16	0.812		131.71	2680	2436	2192	1754	1462	1218	974	731	487
16	0.844	80	136.61	2785	2532	2279	1823	1519	1266	1013	760	506
16	1.000		160.20	3300	3000	2700	2160	1800	1500	1200	900	600

EXHIBIT B
(4 of 72)

YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
18	0.250		47.39	733	667	600	480	400	333	267	200	133
18	0.281		53.18	824	749	674	540	450	375	300	225	150
18	0.312		58.94	915	832	749	599	499	416	333	250	166
18	0.344		64.87	1009	917	826	660	550	459	367	275	183
18	0.375	STD	70.59	1100	1000	900	720	600	500	400	300	200
18	0.406		76.29	1191	1083	974	780	650	541	433	325	217
18	0.438		82.15	1285	1168	1051	841	701	584	467	350	234
18	0.469		87.81	1376	1251	1126	900	750	625	500	375	250
18	0.500	XS	93.45	1467	1333	1200	960	800	667	533	400	267
18	0.562	40	104.66	1649	1499	1349	1079	899	749	599	450	300
18	0.625		115.98	1833	1667	1500	1200	1000	833	667	500	333
18	0.688		127.20	2018	1835	1651	1321	1101	917	734	550	367
18	0.750		138.17	2200	2000	1800	1440	1200	1000	800	600	400
18	0.812		149.05	2382	2165	1949	1559	1299	1083	866	650	433
18	0.938	80	170.92	2751	2501	2251	1801	1501	1251	1001	750	500
18	1.000		181.56	2933	2667	2400	1920	1600	1333	1067	800	533
20	0.250		52.73	660	600	540	432	360	300	240	180	120
20	0.278		58.55	734	667	600	480	400	334	267	200	133
20	0.281		59.18	742	674	607	486	405	337	270	202	135
20	0.312		65.60	824	749	674	539	449	374	300	225	150
20	0.334		70.15	882	802	721	577	481	401	321	240	160
20	0.344		72.21	908	826	743	594	495	413	330	248	165
20	0.347		72.83	916	833	750	600	500	416	333	250	167
20	0.375	STD	78.60	990	900	810	648	540	450	360	270	180
20	0.406		84.96	1072	974	877	702	585	487	390	292	195
20	0.417		87.21	1101	1001	901	721	600	500	400	300	200
20	0.438		91.51	1156	1051	946	757	631	526	420	315	210
20	0.462		96.40	1220	1109	998	798	665	554	444	333	222
20	0.469		97.83	1238	1126	1013	810	675	563	450	338	225
20	0.500	XS	104.13	1320	1200	1080	864	720	600	480	360	240
20	0.562		116.67	1484	1349	1214	971	809	674	540	405	270
20	0.594	40	123.11	1568	1426	1283	1026	855	713	570	428	285
20	0.625		129.33	1650	1500	1350	1080	900	750	600	450	300
20	0.688		141.90	1816	1651	1486	1189	991	826	660	495	330
20	0.750		154.19	1980	1800	1620	1296	1080	900	720	540	360
20	0.812		166.40	2144	1949	1754	1403	1169	974	780	585	390
20	1.000		202.92	2640	2400	2160	1728	1440	1200	960	720	480
22	0.250		58.07	600	545	491	393	327	273	218	164	109
22	0.281		65.18	674	613	552	441	368	307	245	184	123
22	0.312		72.27	749	681	613	490	408	340	272	204	136
22	0.344		79.56	826	751	675	540	450	375	300	225	150
22	0.375	STD	86.61	900	818	736	589	491	409	327	245	164
22	0.438		100.86	1051	956	860	688	573	478	382	287	191
22	0.500	XS	114.81	1200	1091	982	785	655	545	436	327	218
22	0.562		128.67	1349	1226	1104	883	736	613	490	368	245
22	0.625		142.68	1500	1364	1227	982	818	682	545	409	273
22	0.688		156.59	1651	1501	1351	1081	901	751	600	450	300
22	0.750		170.21	1800	1636	1473	1178	982	818	655	491	327
22	0.812		183.74	1949	1772	1594	1276	1063	886	709	531	354
24	0.250		63.41	550	500	450	360	300	250	200	150	100
24	0.257		65.17	565	514	463	370	308	257	206	154	103
24	0.278		70.43	612	556	500	400	334	278	222	167	111
24	0.281		71.18	618	562	506	405	337	281	225	169	112
24	0.300		75.93	660	600	540	432	360	300	240	180	120
24	0.312		78.93	686	624	562	449	374	312	250	187	125
24	0.334		84.42	735	668	601	481	401	334	267	200	134
24	0.344		86.91	757	688	619	495	413	344	275	206	138
24	0.370		93.37	814	740	666	533	444	370	296	222	148

EXHIBIT B
(5 of 72)

YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
24	0.375	STD	94.62	825	750	675	540	450	375	300	225	150
24	0.406		102.30	893	812	731	585	487	406	325	244	162
24	0.420		105.77	924	840	756	605	504	420	336	252	168
24	0.438		110.22	964	876	788	631	526	438	350	263	175
24	0.469		117.86	1032	938	844	675	563	469	375	281	188
24	0.500	XS	125.49	1100	1000	900	720	600	500	400	300	200
24	0.562		140.68	1236	1124	1012	809	674	562	450	337	225
24	0.625		156.03	1375	1250	1125	900	750	625	500	375	250
24	0.688	40	171.29	1514	1376	1238	991	826	688	550	413	275
24	0.750		186.23	1650	1500	1350	1080	900	750	600	450	300
24	0.812		201.09	1786	1624	1462	1169	974	812	650	487	325
24	1.000		245.64	2200	2000	1800	1440	1200	1000	800	600	400
26	0.250		68.75	508	462	415	332	277	231	185	138	92
26	0.278		76.37	565	513	462	370	308	257	205	154	103
26	0.281		77.18	571	519	467	374	311	259	208	156	104
26	0.301		82.61	611	556	500	400	333	278	222	167	111
26	0.312		85.60	634	576	518	415	346	288	230	173	115
26	0.334		91.55	678	617	555	444	370	308	247	185	123
26	0.344		94.26	699	635	572	457	381	318	254	191	127
26	0.361		98.85	733	666	600	480	400	333	267	200	133
26	0.375	STD	102.63	762	692	623	498	415	346	277	208	138
26	0.406		110.98	824	750	675	540	450	375	300	225	150
26	0.438		119.57	889	809	728	582	485	404	323	243	162
26	0.469		127.88	952	866	779	623	520	433	346	260	173
26	0.500	XS	136.17	1015	923	831	665	554	462	369	277	185
26	0.562		152.68	1141	1038	934	747	623	519	415	311	208
26	0.625		169.38	1269	1154	1038	831	692	577	462	346	231
26	0.688		185.99	1397	1270	1143	915	762	635	508	381	254
26	0.750		202.25	1523	1385	1246	997	831	692	554	415	277
26	0.875		234.79	1777	1615	1454	1163	969	808	646	485	323
26	1.000		267.00	2031	1846	1662	1329	1108	923	738	554	369
28	0.250		74.09	471	429	386	309	257	214	171	129	86
28	0.281		83.19	530	482	434	347	289	241	193	145	96
28	0.312		92.26	588	535	481	385	321	267	214	160	107
28	0.344		101.60	649	590	531	425	354	295	236	177	118
28	0.375	STD	110.64	707	643	579	463	386	321	257	193	129
28	0.406		119.65	766	696	626	501	418	348	278	209	139
28	0.438		128.93	826	751	676	541	451	375	300	225	150
28	0.469		137.90	884	804	724	579	482	402	322	241	161
28	0.500	XS	146.85	943	857	771	617	514	429	343	257	171
28	0.562		164.68	1060	963	867	694	578	482	385	289	193
28	0.625		182.73	1179	1071	964	771	643	536	429	321	214
30	0.281		89.19	495	450	405	324	270	225	180	135	90
30	0.300		95.16	528	480	432	346	288	240	192	144	96
30	0.312		98.92	549	499	449	359	300	250	200	150	100
30	0.321		101.75	565	514	462	370	308	257	205	154	103
30	0.323		102.37	568	517	465	372	310	258	207	155	103
30	0.325		103.00	572	520	468	374	312	260	208	156	104
30	0.344		108.95	605	550	495	396	330	275	220	165	110
30	0.347		109.89	611	555	500	400	333	278	222	167	111
30	0.360		113.96	634	576	518	415	346	288	230	173	115
30	0.375	STD	118.65	660	600	540	432	360	300	240	180	120
30	0.385		121.77	678	616	554	444	370	308	246	185	123
30	0.400		126.45	704	640	576	461	384	320	256	192	128
30	0.406		128.32	715	650	585	468	390	325	260	195	130
30	0.417		131.75	734	667	600	480	400	334	267	200	133
30	0.420		132.68	739	672	605	484	403	336	269	202	134
30	0.422		133.30	743	675	608	486	405	338	270	203	135

EXHIBIT B
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YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
30	0.438		138.28	771	701	631	505	420	350	280	210	140
30	0.469		147.92	825	750	675	540	450	375	300	225	150
30	0.480		151.33	845	768	691	553	461	384	307	230	154
30	0.500	XS	157.53	880	800	720	576	480	400	320	240	160
30	0.504		158.77	887	806	726	581	484	403	323	242	161
30	0.525		165.26	924	840	756	605	504	420	336	252	168
30	0.530		166.81	933	848	763	611	509	424	339	254	170
30	0.562		176.69	989	899	809	647	540	450	360	270	180
30	0.563		177.00	991	901	811	649	540	450	360	270	180
30	0.625		196.08	1100	1000	900	720	600	500	400	300	200
30	0.750		234.29	1320	1200	1080	864	720	600	480	360	240
30	0.875		272.17	1540	1400	1260	1008	840	700	560	420	280
30	1.000		309.72	1760	1600	1440	1152	960	800	640	480	320
30.2	0.423		134.52	740	672	605	484	403	336	269	202	134
32	0.250		84.77	413	375	338	270	225	188	150	113	75
32	0.281		95.19	464	422	379	303	253	211	169	126	84
32	0.312		105.59	515	468	421	337	281	234	187	140	94
32	0.344		116.30	568	516	464	372	310	258	206	155	103
32	0.375	STD	126.66	619	563	506	405	338	281	225	169	113
32	0.406		136.99	670	609	548	438	365	305	244	183	122
32	0.438		147.64	723	657	591	473	394	329	263	197	131
32	0.469		157.93	774	704	633	507	422	352	281	211	141
32	0.500	XS	168.21	825	750	675	540	450	375	300	225	150
32	0.562		188.69	927	843	759	607	506	422	337	253	169
32	0.625		209.43	1031	938	844	675	563	469	375	281	188
34	0.250		90.11	388	353	318	254	212	176	141	106	71
34	0.281		101.19	436	397	357	286	238	198	159	119	79
34	0.312		112.25	485	440	396	317	264	220	176	132	88
34	0.344		123.65	534	486	437	350	291	243	194	146	97
34	0.375	STD	134.67	582	529	476	381	318	265	212	159	106
34	0.406		145.66	630	573	516	413	344	287	229	172	115
34	0.438		157.00	680	618	557	445	371	309	247	186	124
34	0.469		167.95	728	662	596	477	397	331	265	199	132
34	0.500	XS	178.89	776	706	635	508	424	353	282	212	141
34	0.562		200.70	873	793	714	571	476	397	317	238	159
34	0.625		222.77	971	882	794	635	529	441	353	265	176
36	0.312		118.92	458	416	374	300	250	208	166	125	83
36	0.344		131.00	505	459	413	330	275	229	183	138	92
36	0.356		135.52	522	475	427	342	285	237	190	142	95
36	0.375	STD	142.68	550	500	450	360	300	250	200	150	100
36	0.385		146.44	565	513	462	370	308	257	205	154	103
36	0.388		147.57	569	517	466	372	310	259	207	155	103
36	0.406		154.34	595	541	487	390	325	271	217	162	108
36	0.417		158.47	612	556	500	400	334	278	222	167	111
36	0.438		166.35	642	584	526	420	350	292	234	175	117
36	0.450		170.85	660	600	540	432	360	300	240	180	120
36	0.469		177.97	688	625	563	450	375	313	250	188	125
36	0.500	XS	189.57	733	667	600	480	400	333	267	200	133
36	0.504		191.06	739	672	605	484	403	336	269	202	134
36	0.525		198.91	770	700	630	504	420	350	280	210	140
36	0.540		204.50	792	720	648	518	432	360	288	216	144
36	0.562		212.70	824	749	674	540	450	375	300	225	150
36	0.600		226.84	880	800	720	576	480	400	320	240	160
36	0.605		228.70	887	807	726	581	484	403	323	242	161
36	0.625		236.12	917	833	750	600	500	417	333	250	167
36	0.660		249.10	968	880	792	634	528	440	352	264	176
36	0.688		259.46	1009	917	826	660	550	459	367	275	183

EXHIBIT B
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YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
36	0.750		282.35	1100	1000	900	720	600	500	400	300	200
36	0.875		328.24	1283	1167	1050	840	700	583	467	350	233
36	1.000		373.79	1467	1333	1200	960	800	667	533	400	267
36.24	0.508		193.86	740	673	606	484	404	336	269	202	135
38	0.312		125.58	434	394	355	284	236	197	158	118	79
38	0.344		138.34	478	435	391	313	261	217	174	130	87
38	0.375	STD	150.69	521	474	426	341	284	237	189	142	95
38	0.406		163.01	564	513	462	369	308	256	205	154	103
38	0.438		175.71	609	553	498	398	332	277	221	166	111
38	0.469		187.99	652	592	533	427	355	296	237	178	118
38	0.500	XS	200.25	695	632	568	455	379	316	253	189	126
38	0.562		224.71	781	710	639	511	426	355	284	213	142
38	0.625		249.47	868	789	711	568	474	395	316	237	158
40	0.344		145.69	454	413	372	297	248	206	165	124	83
40	0.375	STD	158.70	495	450	405	324	270	225	180	135	90
40	0.406		171.68	536	487	438	351	292	244	195	146	97
40	0.438		185.06	578	526	473	378	315	263	210	158	105
40	0.469		198.00	619	563	507	405	338	281	225	169	113
40	0.500	XS	210.93	660	600	540	432	360	300	240	180	120
40	0.562		236.71	742	674	607	486	405	337	270	202	135
40	0.625		262.82	825	750	675	540	450	375	300	225	150
42	0.312		138.91	392	357	321	257	214	178	143	107	71
42	0.323		143.77	406	369	332	266	221	185	148	111	74
42	0.344		153.04	432	393	354	283	236	197	157	118	79
42	0.363		161.42	456	415	373	299	249	207	166	124	83
42	0.375	STD	166.71	471	429	386	309	257	214	171	129	86
42	0.406		180.35	510	464	418	334	278	232	186	139	93
42	0.417		185.19	524	477	429	343	286	238	191	143	95
42	0.438		194.42	551	501	451	360	300	250	200	150	100
42	0.450		199.69	566	514	463	370	309	257	206	154	103
42	0.469		208.02	590	536	482	386	322	268	214	161	107
42	0.486		215.47	611	555	500	400	333	278	222	167	111
42	0.500	XS	221.61	629	571	514	411	343	286	229	171	114
42	0.562		248.71	707	642	578	462	385	321	257	193	128
42	0.625		276.17	786	714	643	514	429	357	286	214	143
42	0.688		303.55	865	786	708	566	472	393	315	236	157
42	0.750		330.41	943	857	771	617	514	429	343	257	171
42	0.812		357.18	1021	928	835	668	557	464	371	278	186
42	0.875		384.31	1100	1000	900	720	600	500	400	300	200
42	1.000		437.87	1257	1143	1029	823	686	571	457	343	229
44	0.312		145.57	374	340	306	245	204	170	136	102	68
44	0.334		155.76	401	364	328	262	219	182	146	109	73
44	0.344		160.39	413	375	338	270	225	188	150	113	75
44	0.370		172.41	444	404	363	291	242	202	161	121	81
44	0.375	STD	174.72	450	409	368	295	245	205	164	123	82
44	0.406		189.02	487	443	399	319	266	221	177	133	89
44	0.417		194.10	500	455	409	328	273	227	182	136	91
44	0.438		203.77	526	478	430	344	287	239	191	143	96
44	0.469		218.04	563	512	460	368	307	256	205	153	102
44	0.476		221.26	571	519	467	374	312	260	208	156	104
44	0.500	XS	232.29	600	545	491	393	327	273	218	164	109
44	0.513		238.25	616	560	504	403	336	280	224	168	112
44	0.556		257.97	667	607	546	437	364	303	243	182	121
44	0.562		260.72	674	613	552	441	368	307	245	184	123
44	0.625		289.52	750	682	614	491	409	341	273	205	136
44	0.688		318.25	826	751	675	540	450	375	300	225	150

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 23 of 87

EXHIBIT B
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YIELD 24,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
44	0.750		346.43	900	818	736	589	491	409	327	245	164
44	0.812		374.53	974	886	797	638	531	443	354	266	177
44	0.875		403.00	1050	955	859	687	573	477	382	286	191
44	1.000		459.23	1200	1091	982	785	655	545	436	327	218
46	0.312		152.24	358	326	293	234	195	163	130	98	65
46	0.334		162.89	383	349	314	251	209	174	139	105	70
46	0.344		167.73	395	359	323	258	215	179	144	108	72
46	0.370		180.31	425	386	347	278	232	193	154	116	77
46	0.375	STD	182.73	430	391	352	282	235	196	157	117	78
46	0.406		197.70	466	424	381	305	254	212	169	127	85
46	0.417		203.00	479	435	392	313	261	218	174	131	87
46	0.438		213.13	503	457	411	329	274	229	183	137	91
46	0.469		228.06	538	489	440	352	294	245	196	147	98
46	0.476		231.43	546	497	447	358	298	248	199	149	99
46	0.500	XS	242.97	574	522	470	376	313	261	209	157	104
46	0.513		249.21	589	535	482	385	321	268	214	161	107
46	0.556		269.85	638	580	522	418	348	290	232	174	116
46	0.562		272.72	645	586	528	422	352	293	235	176	117
46	0.625		302.87	717	652	587	470	391	326	261	196	130
46	0.688		332.94	790	718	646	517	431	359	287	215	144
46	0.750		362.45	861	783	704	563	470	391	313	235	157
46	0.812		391.87	932	847	763	610	508	424	339	254	169
46	0.875		421.69	1004	913	822	657	548	457	365	274	183
46	1.000		480.59	1148	1043	939	751	626	522	417	313	209
48	0.312		158.90	343	312	281	225	187	156	125	94	62
48	0.334		170.03	367	334	301	240	200	167	134	100	67
48	0.344		175.08	378	344	310	248	206	172	138	103	69
48	0.370		188.21	407	370	333	266	222	185	148	111	74
48	0.375	STD	190.74	413	375	338	270	225	188	150	113	75
48	0.406		206.37	447	406	365	292	244	203	162	122	81
48	0.417		211.91	459	417	375	300	250	209	167	125	83
48	0.438		222.48	482	438	394	315	263	219	175	131	88
48	0.469		238.08	516	469	422	338	281	235	188	141	94
48	0.476		241.59	524	476	428	343	286	238	190	143	95
48	0.500	XS	253.65	550	500	450	360	300	250	200	150	100
48	0.513		260.17	564	513	462	369	308	257	205	154	103
48	0.556		281.72	612	556	500	400	334	278	222	167	111
48	0.562		284.73	618	562	506	405	337	281	225	169	112
48	0.625		316.22	688	625	563	450	375	313	250	188	125
48	0.688		347.64	757	688	619	495	413	344	275	206	138
48	0.750		378.47	825	750	675	540	450	375	300	225	150
48	0.812		409.22	893	812	731	585	487	406	325	244	162
48	0.875		440.38	963	875	788	630	525	438	350	263	175
48	1.000		501.95	1100	1000	900	720	600	500	400	300	200

EXHIBIT B
(9 of 72)

YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
1/2	0.109	STD - 40	0.85	9992	9083	8175	6540	5450	4542	3633	2725	1817
1/2	0.147	XS - 80	1.09	13475	12250	11025	8820	7350	6125	4900	3675	2450
1/2	0.188	160	1.31	17233	15667	14100	11280	9400	7833	6267	4700	3133
1/2	0.294	XXS	1.71	26950	24500	22050	17640	14700	12250	9800	7350	4900
3/4	0.113	STD - 40	1.13	8287	7533	6780	5424	4520	3767	3013	2260	1507
3/4	0.154	XS - 80	1.47	11293	10267	9240	7392	6160	5133	4107	3080	2053
3/4	0.219	160	1.94	16060	14600	13140	10512	8760	7300	5840	4380	2920
3/4	0.308	XXS	2.44	22587	20533	18480	14784	12320	10267	8213	6160	4107
1	0.133	STD - 40	1.68	7788	7080	6372	5097	4248	3540	2832	2124	1416
1	0.179	XS - 80	2.17	10481	9529	8576	6861	5717	4764	3811	2859	1906
1	0.250	160	2.84	14639	13308	11977	9582	7985	6654	5323	3992	2662
1	0.358	XXS	3.66	20963	19057	17151	13721	11434	9529	7623	5717	3811
1 1/4	0.140	STD - 40	2.27	6494	5904	5313	4251	3542	2952	2361	1771	1181
1 1/4	0.191	XS - 80	3.00	8860	8054	7249	5799	4833	4027	3222	2416	1611
1 1/4	0.250	160	3.76	11596	10542	9488	7590	6325	5271	4217	3163	2108
1 1/4	0.382	XXS	5.21	17719	16108	14498	11598	9665	8054	6443	4833	3222
1 1/2	0.145	STD - 40	2.72	5876	5342	4808	3846	3205	2671	2137	1603	1068
1 1/2	0.200	XS - 80	3.63	8105	7368	6632	5305	4421	3684	2947	2211	1474
1 1/2	0.281	160	4.86	11388	10353	9317	7454	6212	5176	4141	3106	2071
1 1/2	0.400	XXS	6.41	16211	14737	13263	10611	8842	7368	5895	4421	2947
2	0.154	STD - 40	3.65	4993	4539	4085	3268	2723	2269	1816	1362	908
2	0.218	XS - 80	5.02	7068	6425	5783	4626	3855	3213	2570	1928	1285
2	0.250		5.67	8105	7368	6632	5305	4421	3684	2947	2211	1474
2	0.344	160	7.46	11153	10139	9125	7300	6083	5069	4056	3042	2028
2	0.436	XXS	9.03	14136	12851	11565	9252	7710	6425	5140	3855	2570
3	0.125		4.51	2750	2500	2250	1800	1500	1250	1000	750	500
3	0.156		5.57	3432	3120	2808	2246	1872	1560	1248	936	624
3	0.188		6.65	4136	3760	3384	2707	2256	1880	1504	1128	752
3	0.216	STD - 40	7.58	4752	4320	3888	3110	2592	2160	1728	1296	864
3	0.250		8.68	5500	5000	4500	3600	3000	2500	2000	1500	1000
3	0.281		9.66	6182	5620	5058	4046	3372	2810	2248	1686	1124
3	0.300	XS - 80	10.25	6600	6000	5400	4320	3600	3000	2400	1800	1200
3	0.438	160	14.32	9636	8760	7884	6307	5256	4380	3504	2628	1752
3	0.600	XXS	18.58	13200	12000	10800	8640	7200	6000	4800	3600	2400
4	0.125		5.84	2139	1944	1750	1400	1167	972	778	583	389
4	0.141		6.56	2413	2193	1974	1579	1316	1097	877	658	439
4	0.156		7.24	2669	2427	2184	1747	1456	1213	971	728	485
4	0.172		7.95	2943	2676	2408	1926	1605	1338	1070	803	535
4	0.188		8.66	3217	2924	2632	2106	1755	1462	1170	877	585
4	0.203		9.32	3474	3158	2842	2274	1895	1579	1263	947	632
4	0.219		10.01	3747	3407	3066	2453	2044	1703	1363	1022	681
4	0.237	STD - 40	10.79	4055	3687	3318	2654	2212	1843	1475	1106	737
4	0.250		11.35	4278	3889	3500	2800	2333	1944	1556	1167	778
4	0.281		12.66	4808	4371	3934	3147	2623	2186	1748	1311	874
4	0.312		13.95	5339	4853	4368	3494	2912	2427	1941	1456	971
4	0.337	XS - 80	14.98	5766	5242	4718	3774	3145	2621	2097	1573	1048
4	0.438	120	19.00	7495	6813	6132	4906	4088	3407	2725	2044	1363
4	0.500		21.36	8556	7778	7000	5600	4667	3889	3111	2333	1556
4	0.531	160	22.51	9086	8260	7434	5947	4956	4130	3304	2478	1652
4	0.674	XXS	27.54	11533	10484	9436	7549	6291	5242	4194	3145	2097
5	0.156		9.01	2159	1963	1767	1413	1178	981	785	589	393
5	0.188		10.79	2602	2366	2129	1703	1419	1183	946	710	473
5	0.219		12.50	3031	2756	2480	1984	1653	1378	1102	827	551

EXHIBIT B
(10 of 72)

YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
5	0.258	STD - 40	14.62	3571	3246	2922	2337	1948	1623	1299	974	649
5	0.281		15.85	3889	3536	3182	2546	2122	1768	1414	1061	707
5	0.312		17.50	4319	3926	3533	2827	2356	1963	1570	1178	785
5	0.344		19.17	4761	4329	3896	3117	2597	2164	1731	1299	866
5	0.375	XS - 80	20.78	5191	4719	4247	3397	2831	2359	1887	1416	944
5	0.500	120	27.04	6921	6292	5662	4530	3775	3146	2517	1887	1258
5	0.625	160	32.96	8651	7864	7078	5662	4719	3932	3146	2359	1573
5	0.750	XXS	38.55	10381	9437	8494	6795	5662	4719	3775	2831	1887
6	0.156		10.78	1813	1648	1483	1187	989	824	659	494	330
6	0.172		11.85	1999	1817	1636	1308	1090	909	727	545	363
6	0.188		12.92	2185	1986	1788	1430	1192	993	795	596	397
6	0.203		13.92	2359	2145	1930	1544	1287	1072	858	643	429
6	0.219		14.98	2545	2314	2083	1666	1388	1157	926	694	463
6	0.250		17.02	2906	2642	2377	1902	1585	1321	1057	792	528
6	0.277		18.78	3219	2927	2634	2107	1756	1463	1171	878	585
6	0.280	STD - 40	18.97	3254	2958	2663	2130	1775	1479	1183	888	592
6	0.312		21.04	3626	3297	2967	2374	1978	1648	1319	989	659
6	0.344		23.08	3998	3635	3271	2617	2181	1817	1454	1090	727
6	0.375		25.03	4358	3962	3566	2853	2377	1981	1585	1189	792
6	0.432	XS - 80	28.57	5021	4565	4108	3286	2739	2282	1826	1369	913
6	0.500		32.71	5811	5283	4755	3804	3170	2642	2113	1585	1057
6	0.562	120	36.39	6532	5938	5344	4275	3563	2969	2375	1781	1188
6	0.625		40.05	7264	6604	5943	4755	3962	3302	2642	1981	1321
6	0.719	160	45.35	8357	7597	6837	5470	4558	3798	3039	2279	1519
6	0.864	XXS	53.16	10042	9129	8216	6573	5477	4565	3652	2739	1826
8	0.172		15.53	1536	1396	1256	1005	838	698	558	419	279
8	0.188		16.94	1678	1526	1373	1099	915	763	610	458	305
8	0.203		18.26	1812	1648	1483	1186	989	824	659	494	330
8	0.219		19.66	1955	1777	1600	1280	1066	889	711	533	355
8	0.250		22.36	2232	2029	1826	1461	1217	1014	812	609	406
8	0.277		24.70	2473	2248	2023	1619	1349	1124	899	674	450
8	0.312		27.70	2785	2532	2279	1823	1519	1266	1013	760	506
8	0.322	STD - 40	28.55	2875	2613	2352	1882	1568	1307	1045	784	523
8	0.344		30.42	3071	2792	2513	2010	1675	1396	1117	838	558
8	0.375		33.04	3348	3043	2739	2191	1826	1522	1217	913	609
8	0.406		35.64	3625	3295	2966	2372	1977	1648	1318	989	659
8	0.438		38.30	3910	3555	3199	2559	2133	1777	1422	1066	711
8	0.500	XS - 80	43.39	4464	4058	3652	2922	2435	2029	1623	1217	812
8	0.562		48.39	5017	4561	4105	3284	2737	2281	1824	1368	912
8	0.594		50.95	5303	4821	4339	3471	2893	2410	1928	1446	964
8	0.625		53.40	5580	5072	4565	3652	3043	2536	2029	1522	1014
8	0.719	120	60.71	6419	5835	5252	4201	3501	2918	2334	1751	1167
8	0.812		67.75	7249	6590	5931	4745	3954	3295	2636	1977	1318
8	0.875	XXS	72.42	7812	7101	6391	5113	4261	3551	2841	2130	1420
8	0.906	160	74.69	8088	7353	6618	5294	4412	3677	2941	2206	1471
10	0.188		21.21	1347	1224	1102	881	735	612	490	367	245
10	0.203		22.87	1454	1322	1190	952	793	661	529	397	264
10	0.219		24.63	1569	1426	1283	1027	856	713	570	428	285
10	0.250		28.03	1791	1628	1465	1172	977	814	651	488	326
10	0.279		31.20	1998	1817	1635	1308	1090	908	727	545	363
10	0.307		34.24	2199	1999	1799	1439	1199	1000	800	600	400
10	0.344		38.23	2464	2240	2016	1613	1344	1120	896	672	448
10	0.365	STD - 40	40.48	2614	2377	2139	1711	1426	1188	951	713	475
10	0.438		48.24	3137	2852	2567	2054	1711	1426	1141	856	570
10	0.500	XS	54.73	3581	3256	2930	2344	1953	1628	1302	977	651
10	0.562		61.15	4025	3660	3294	2635	2196	1830	1464	1098	732
10	0.594	80	64.43	4255	3868	3481	2785	2321	1934	1547	1160	774
10	0.625		67.58	4477	4070	3663	2930	2442	2035	1628	1221	814

EXHIBIT B
(11 of 72)

YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
10	0.719		77.03	5150	4682	4214	3371	2809	2341	1873	1405	936
10	0.750		80.10	5372	4884	4395	3516	2930	2442	1953	1465	977
10	0.812		86.18	5816	5287	4759	3807	3172	2644	2115	1586	1057
10	0.844	120	89.29	6045	5496	4946	3957	3297	2748	2198	1649	1099
10	0.875		92.28	6267	5698	5128	4102	3419	2849	2279	1709	1140
10	1.000	XXS	104.13	7163	6512	5860	4688	3907	3256	2605	1953	1302
12	0.203		27.20	1226	1115	1003	802	669	557	446	334	223
12	0.219		29.31	1323	1202	1082	866	721	601	481	361	240
12	0.250		33.37	1510	1373	1235	988	824	686	549	412	275
12	0.281		37.42	1697	1543	1388	1111	926	771	617	463	309
12	0.312		41.44	1884	1713	1542	1233	1028	856	685	514	343
12	0.330		43.77	1993	1812	1631	1304	1087	906	725	544	362
12	0.344		45.58	2077	1889	1700	1360	1133	944	755	567	378
12	0.375	STD	49.56	2265	2059	1853	1482	1235	1029	824	618	412
12	0.406	40	53.52	2452	2229	2006	1605	1337	1115	892	669	446
12	0.438		57.59	2645	2405	2164	1731	1443	1202	962	721	481
12	0.500	XS	65.41	3020	2745	2471	1976	1647	1373	1098	824	549
12	0.562		73.15	3394	3085	2777	2222	1851	1543	1234	926	617
12	0.625		80.93	3775	3431	3088	2471	2059	1716	1373	1029	686
12	0.688	80	88.63	4155	3777	3400	2720	2266	1889	1511	1133	755
12	0.750		96.12	4529	4118	3706	2965	2471	2059	1647	1235	824
12	0.844		107.32	5097	4634	4170	3336	2780	2317	1853	1390	927
12	0.875		110.97	5284	4804	4324	3459	2882	2402	1922	1441	961
12	1.000	XXS - 120	125.49	6039	5490	4941	3953	3294	2745	2196	1647	1098
14	0.210		30.93	1155	1050	945	756	630	525	420	315	210
14	0.219		32.23	1205	1095	986	788	657	548	438	329	219
14	0.250		36.71	1375	1250	1125	900	750	625	500	375	250
14	0.281		41.17	1546	1405	1265	1012	843	703	562	422	281
14	0.312		45.61	1716	1560	1404	1123	936	780	624	468	312
14	0.344		50.17	1892	1720	1548	1238	1032	860	688	516	344
14	0.375	STD	54.57	2063	1875	1688	1350	1125	938	750	563	375
14	0.438	40	63.44	2409	2190	1971	1577	1314	1095	876	657	438
14	0.469		67.77	2580	2345	2111	1688	1407	1173	938	704	469
14	0.500	XS	72.09	2750	2500	2250	1800	1500	1250	1000	750	500
14	0.562		80.66	3091	2810	2529	2023	1686	1405	1124	843	562
14	0.594		85.05	3267	2970	2673	2138	1782	1485	1188	891	594
14	0.625		89.28	3438	3125	2813	2250	1875	1563	1250	938	625
14	0.688		97.81	3784	3440	3096	2477	2064	1720	1376	1032	688
14	0.750	80	106.13	4125	3750	3375	2700	2250	1875	1500	1125	750
14	0.812		114.37	4466	4060	3654	2923	2436	2030	1624	1218	812
16	0.219		36.91	1054	958	862	690	575	479	383	287	192
16	0.250		42.05	1203	1094	984	788	656	547	438	328	219
16	0.281		47.17	1352	1229	1106	885	738	615	492	369	246
16	0.312		52.27	1502	1365	1229	983	819	683	546	410	273
16	0.344		57.52	1656	1505	1355	1084	903	753	602	452	301
16	0.375	STD	62.58	1805	1641	1477	1181	984	820	656	492	328
16	0.438		72.80	2108	1916	1725	1380	1150	958	767	575	383
16	0.469		77.79	2257	2052	1847	1477	1231	1026	821	616	410
16	0.500	XXS - 40	82.77	2406	2188	1969	1575	1313	1094	875	656	438
16	0.562		92.66	2705	2459	2213	1770	1475	1229	984	738	492
16	0.625		102.63	3008	2734	2461	1969	1641	1367	1094	820	547
16	0.656		107.50	3157	2870	2583	2066	1722	1435	1148	861	574
16	0.688		112.51	3311	3010	2709	2167	1806	1505	1204	903	602
16	0.750		122.15	3609	3281	2953	2363	1969	1641	1313	984	656
16	0.812		131.71	3908	3553	3197	2558	2132	1776	1421	1066	711
16	0.844	80	136.61	4062	3693	3323	2659	2216	1846	1477	1108	739
16	1.000		160.20	4813	4375	3938	3150	2625	2188	1750	1313	875

EXHIBIT B
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YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
18	0.250		47.39	1069	972	875	700	583	486	389	292	194
18	0.281		53.18	1202	1093	984	787	656	546	437	328	219
18	0.312		58.94	1335	1213	1092	874	728	607	485	364	243
18	0.344		64.87	1472	1338	1204	963	803	669	535	401	268
18	0.375	STD	70.59	1604	1458	1313	1050	875	729	583	438	292
18	0.406		76.29	1737	1579	1421	1137	947	789	632	474	316
18	0.438		82.15	1874	1703	1533	1226	1022	852	681	511	341
18	0.469		87.81	2006	1824	1642	1313	1094	912	730	547	365
18	0.500	XS	93.45	2139	1944	1750	1400	1167	972	778	583	389
18	0.562	40	104.66	2404	2186	1967	1574	1311	1093	874	656	437
18	0.625		115.98	2674	2431	2188	1750	1458	1215	972	729	486
18	0.688		127.20	2943	2676	2408	1926	1605	1338	1070	803	535
18	0.750		138.17	3208	2917	2625	2100	1750	1458	1167	875	583
18	0.812		149.05	3474	3158	2842	2274	1895	1579	1263	947	632
18	0.938	80	170.92	4013	3648	3283	2626	2189	1824	1459	1094	730
18	1.000		181.56	4278	3889	3500	2800	2333	1944	1556	1167	778
20	0.250		52.73	963	875	788	630	525	438	350	263	175
20	0.278		58.55	1070	973	876	701	584	487	389	292	195
20	0.281		59.18	1082	984	885	708	590	492	393	295	197
20	0.312		65.60	1201	1092	983	786	655	546	437	328	218
20	0.334		70.15	1286	1169	1052	842	701	585	468	351	234
20	0.344		72.21	1324	1204	1084	867	722	602	482	361	241
20	0.347		72.83	1336	1215	1093	874	729	607	486	364	243
20	0.375	STD	78.60	1444	1313	1181	945	788	656	525	394	263
20	0.406		84.96	1563	1421	1279	1023	853	711	568	426	284
20	0.417		87.21	1605	1460	1314	1051	876	730	584	438	292
20	0.438		91.51	1686	1533	1380	1104	920	767	613	460	307
20	0.462		96.40	1779	1617	1455	1164	970	809	647	485	323
20	0.469		97.83	1806	1642	1477	1182	985	821	657	492	328
20	0.500	XS	104.13	1925	1750	1575	1260	1050	875	700	525	350
20	0.562		116.67	2164	1967	1770	1416	1180	984	787	590	393
20	0.594	40	123.11	2287	2079	1871	1497	1247	1040	832	624	416
20	0.625		129.33	2406	2188	1969	1575	1313	1094	875	656	438
20	0.688		141.90	2649	2408	2167	1734	1445	1204	963	722	482
20	0.750		154.19	2888	2625	2363	1890	1575	1313	1050	788	525
20	0.812		166.40	3126	2842	2558	2046	1705	1421	1137	853	568
20	1.000		202.92	3850	3500	3150	2520	2100	1750	1400	1050	700
22	0.250		58.07	875	795	716	573	477	398	318	239	159
22	0.281		65.18	984	894	805	644	536	447	358	268	179
22	0.312		72.27	1092	993	893	715	596	496	397	298	199
22	0.344		79.56	1204	1095	985	788	657	547	438	328	219
22	0.375	STD	86.61	1313	1193	1074	859	716	597	477	358	239
22	0.438		100.86	1533	1394	1254	1003	836	697	557	418	279
22	0.500	XS	114.81	1750	1591	1432	1145	955	795	636	477	318
22	0.562		128.67	1967	1788	1609	1287	1073	894	715	536	358
22	0.625		142.68	2188	1989	1790	1432	1193	994	795	597	398
22	0.688		156.59	2408	2189	1970	1576	1313	1095	876	657	438
22	0.750		170.21	2625	2386	2148	1718	1432	1193	955	716	477
22	0.812		183.74	2842	2584	2325	1860	1550	1292	1033	775	517
24	0.250		63.41	802	729	656	525	438	365	292	219	146
24	0.257		65.17	825	750	675	540	450	375	300	225	150
24	0.278		70.43	892	811	730	584	487	405	324	243	162
24	0.281		71.18	902	820	738	590	492	410	328	246	164
24	0.300		75.93	963	875	788	630	525	438	350	263	175
24	0.312		78.93	1001	910	819	655	546	455	364	273	182
24	0.334		84.42	1072	974	877	701	585	487	390	292	195
24	0.344		86.91	1104	1003	903	722	602	502	401	301	201
24	0.370		93.37	1187	1079	971	777	648	540	432	324	216

EXHIBIT B
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YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
24	0.375	STD	94.62	1203	1094	984	788	656	547	438	328	219
24	0.406		102.30	1303	1184	1066	853	711	592	474	355	237
24	0.420		105.77	1348	1225	1103	882	735	613	490	368	245
24	0.438		110.22	1405	1278	1150	920	767	639	511	383	256
24	0.469		117.86	1505	1368	1231	985	821	684	547	410	274
24	0.500	XS	125.49	1604	1458	1313	1050	875	729	583	438	292
24	0.562		140.68	1803	1639	1475	1180	984	820	656	492	328
24	0.625		156.03	2005	1823	1641	1313	1094	911	729	547	365
24	0.688	40	171.29	2207	2007	1806	1445	1204	1003	803	602	401
24	0.750		186.23	2406	2188	1969	1575	1313	1094	875	656	438
24	0.812		201.09	2605	2368	2132	1705	1421	1184	947	711	474
24	1.000		245.64	3208	2917	2625	2100	1750	1458	1167	875	583
26	0.250		68.75	740	673	606	485	404	337	269	202	135
26	0.278		76.37	823	748	674	539	449	374	299	225	150
26	0.281		77.18	832	757	681	545	454	378	303	227	151
26	0.301		82.61	891	810	729	583	486	405	324	243	162
26	0.312		85.60	924	840	756	605	504	420	336	252	168
26	0.334		91.55	989	899	809	647	540	450	360	270	180
26	0.344		94.26	1019	926	834	667	556	463	370	278	185
26	0.361		98.85	1069	972	875	700	583	486	389	292	194
26	0.375	STD	102.63	1111	1010	909	727	606	505	404	303	202
26	0.406		110.98	1202	1093	984	787	656	547	437	328	219
26	0.438		119.57	1297	1179	1061	849	708	590	472	354	236
26	0.469		127.88	1389	1263	1136	909	758	631	505	379	253
26	0.500	XS	136.17	1481	1346	1212	969	808	673	538	404	269
26	0.562		152.68	1664	1513	1362	1089	908	757	605	454	303
26	0.625		169.38	1851	1683	1514	1212	1010	841	673	505	337
26	0.688		185.99	2038	1852	1667	1334	1111	926	741	556	370
26	0.750		202.25	2221	2019	1817	1454	1212	1010	808	606	404
26	0.875		234.79	2591	2356	2120	1696	1413	1178	942	707	471
26	1.000		267.00	2962	2692	2423	1938	1615	1346	1077	808	538
28	0.250		74.09	688	625	563	450	375	313	250	188	125
28	0.281		83.19	773	703	632	506	422	351	281	211	141
28	0.312		92.26	858	780	702	562	468	390	312	234	156
28	0.344		101.60	946	860	774	619	516	430	344	258	172
28	0.375	STD	110.64	1031	938	844	675	563	469	375	281	188
28	0.406		119.65	1117	1015	914	731	609	508	406	305	203
28	0.438		128.93	1205	1095	986	788	657	548	438	329	219
28	0.469		137.90	1290	1173	1055	844	704	586	469	352	235
28	0.500	XS	146.85	1375	1250	1125	900	750	625	500	375	250
28	0.562		164.68	1546	1405	1265	1012	843	703	562	422	281
28	0.625		182.73	1719	1563	1406	1125	938	781	625	469	313
30	0.281		89.19	721	656	590	472	393	328	262	197	131
30	0.300		95.16	770	700	630	504	420	350	280	210	140
30	0.312		98.92	801	728	655	524	437	364	291	218	146
30	0.321		101.75	824	749	674	539	449	375	300	225	150
30	0.323		102.37	829	754	678	543	452	377	301	226	151
30	0.325		103.00	834	758	683	546	455	379	303	228	152
30	0.344		108.95	883	803	722	578	482	401	321	241	161
30	0.347		109.89	891	810	729	583	486	405	324	243	162
30	0.360		113.96	924	840	756	605	504	420	336	252	168
30	0.375	STD	118.65	963	875	788	630	525	438	350	263	175
30	0.385		121.77	988	898	809	647	539	449	359	270	180
30	0.400		126.45	1027	933	840	672	560	467	373	280	187
30	0.406		128.32	1042	947	853	682	568	474	379	284	189
30	0.417		131.75	1070	973	876	701	584	487	389	292	195
30	0.420		132.68	1078	980	882	706	588	490	392	294	196
30	0.422		133.30	1083	985	886	709	591	492	394	295	197

EXHIBIT B
(14 of 72)

YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
30	0.438		138.28	1124	1022	920	736	613	511	409	307	204
30	0.469		147.92	1204	1094	985	788	657	547	438	328	219
30	0.480		151.33	1232	1120	1008	806	672	560	448	336	224
30	0.500	XS	157.53	1283	1167	1050	840	700	583	467	350	233
30	0.504		158.77	1294	1176	1058	847	706	588	470	353	235
30	0.525		165.26	1348	1225	1103	882	735	613	490	368	245
30	0.530		166.81	1360	1237	1113	890	742	618	495	371	247
30	0.562		176.69	1442	1311	1180	944	787	656	525	393	262
30	0.563		177.00	1445	1314	1182	946	788	657	525	394	263
30	0.625		196.08	1604	1458	1313	1050	875	729	583	438	292
30	0.750		234.29	1925	1750	1575	1260	1050	875	700	525	350
30	0.875		272.17	2246	2042	1838	1470	1225	1021	817	613	408
30	1.000		309.72	2567	2333	2100	1680	1400	1167	933	700	467
30.2	0.423		134.52	1079	980	882	706	588	490	392	294	196
32	0.250		84.77	602	547	492	394	328	273	219	164	109
32	0.281		95.19	676	615	553	443	369	307	246	184	123
32	0.312		105.59	751	683	614	491	410	341	273	205	137
32	0.344		116.30	828	753	677	542	452	376	301	226	151
32	0.375	STD	126.66	902	820	738	591	492	410	328	246	164
32	0.406		136.99	977	888	799	639	533	444	355	266	178
32	0.438		147.64	1054	958	862	690	575	479	383	287	192
32	0.469		157.93	1129	1026	923	739	616	513	410	308	205
32	0.500	XS	168.21	1203	1094	984	788	656	547	438	328	219
32	0.562		188.69	1352	1229	1106	885	738	615	492	369	246
32	0.625		209.43	1504	1367	1230	984	820	684	547	410	273
34	0.250		90.11	566	515	463	371	309	257	206	154	103
34	0.281		101.19	636	579	521	417	347	289	231	174	116
34	0.312		112.25	707	642	578	462	385	321	257	193	128
34	0.344		123.65	779	708	637	510	425	354	283	212	142
34	0.375	STD	134.67	849	772	695	556	463	386	309	232	154
34	0.406		145.66	919	836	752	602	502	418	334	251	167
34	0.438		157.00	992	902	812	649	541	451	361	271	180
34	0.469		167.95	1062	966	869	695	579	483	386	290	193
34	0.500	XS	178.89	1132	1029	926	741	618	515	412	309	206
34	0.562		200.70	1273	1157	1041	833	694	579	463	347	231
34	0.625		222.77	1415	1287	1158	926	772	643	515	386	257
36	0.312		118.92	667	607	546	437	364	303	243	182	121
36	0.344		131.00	736	669	602	482	401	334	268	201	134
36	0.356		135.52	761	692	623	498	415	346	277	208	138
36	0.375	STD	142.68	802	729	656	525	438	365	292	219	146
36	0.385		146.44	823	749	674	539	449	374	299	225	150
36	0.388		147.57	830	754	679	543	453	377	302	226	151
36	0.406		154.34	868	789	711	568	474	395	316	237	158
36	0.417		158.47	892	811	730	584	487	405	324	243	162
36	0.438		166.35	937	852	767	613	511	426	341	256	170
36	0.450		170.85	963	875	788	630	525	438	350	263	175
36	0.469		177.97	1003	912	821	657	547	456	365	274	182
36	0.500	XS	189.57	1069	972	875	700	583	486	389	292	194
36	0.504		191.06	1078	980	882	706	588	490	392	294	196
36	0.525		198.91	1123	1021	919	735	613	510	408	306	204
36	0.540		204.50	1155	1050	945	756	630	525	420	315	210
36	0.562		212.70	1202	1093	984	787	656	546	437	328	219
36	0.600		226.84	1283	1167	1050	840	700	583	467	350	233
36	0.605		228.70	1294	1176	1059	847	706	588	471	353	235
36	0.625		236.12	1337	1215	1094	875	729	608	486	365	243
36	0.660		249.10	1412	1283	1155	924	770	642	513	385	257
36	0.688		259.46	1472	1338	1204	963	803	669	535	401	268

EXHIBIT B
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YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
36	0.750		282.35	1604	1458	1313	1050	875	729	583	438	292
36	0.875		328.24	1872	1701	1531	1225	1021	851	681	510	340
36	1.000		373.79	2139	1944	1750	1400	1167	972	778	583	389
36.24	0.508		193.86	1079	981	883	706	589	491	392	294	196
38	0.312		125.58	632	575	517	414	345	287	230	172	115
38	0.344		138.34	697	634	570	456	380	317	253	190	127
38	0.375	STD	150.69	760	691	622	497	414	345	276	207	138
38	0.406		163.01	823	748	673	538	449	374	299	224	150
38	0.438		175.71	888	807	726	581	484	403	323	242	161
38	0.469		187.99	950	864	778	622	518	432	346	259	173
38	0.500	XS	200.25	1013	921	829	663	553	461	368	276	184
38	0.562		224.71	1139	1035	932	745	621	518	414	311	207
38	0.625		249.47	1266	1151	1036	829	691	576	461	345	230
40	0.344		145.69	662	602	542	433	361	301	241	181	120
40	0.375	STD	158.70	722	656	591	473	394	328	263	197	131
40	0.406		171.68	782	711	639	512	426	355	284	213	142
40	0.438		185.06	843	767	690	552	460	383	307	230	153
40	0.469		198.00	903	821	739	591	492	410	328	246	164
40	0.500	XS	210.93	963	875	788	630	525	438	350	263	175
40	0.562		236.71	1082	984	885	708	590	492	393	295	197
40	0.625		262.82	1203	1094	984	788	656	547	438	328	219
42	0.312		138.91	572	520	468	374	312	260	208	156	104
42	0.323		143.77	592	538	485	388	323	269	215	162	108
42	0.344		153.04	631	573	516	413	344	287	229	172	115
42	0.363		161.42	666	605	545	436	363	303	242	182	121
42	0.375	STD	166.71	688	625	563	450	375	313	250	188	125
42	0.406		180.35	744	677	609	487	406	338	271	203	135
42	0.417		185.19	765	695	626	500	417	348	278	209	139
42	0.438		194.42	803	730	657	526	438	365	292	219	146
42	0.450		199.69	825	750	675	540	450	375	300	225	150
42	0.469		208.02	860	782	704	563	469	391	313	235	156
42	0.486		215.47	891	810	729	583	486	405	324	243	162
42	0.500	XS	221.61	917	833	750	600	500	417	333	250	167
42	0.562		248.71	1030	937	843	674	562	468	375	281	187
42	0.625		276.17	1146	1042	938	750	625	521	417	313	208
42	0.688		303.55	1261	1147	1032	826	688	573	459	344	229
42	0.750		330.41	1375	1250	1125	900	750	625	500	375	250
42	0.812		357.18	1489	1353	1218	974	812	677	541	406	271
42	0.875		384.31	1604	1458	1313	1050	875	729	583	438	292
42	1.000		437.87	1833	1667	1500	1200	1000	833	667	500	333
44	0.312		145.57	546	496	447	357	298	248	199	149	99
44	0.334		155.76	585	531	478	383	319	266	213	159	106
44	0.344		160.39	602	547	493	394	328	274	219	164	109
44	0.370		172.41	648	589	530	424	353	294	235	177	118
44	0.375	STD	174.72	656	597	537	430	358	298	239	179	119
44	0.406		189.02	711	646	581	465	388	323	258	194	129
44	0.417		194.10	730	663	597	478	398	332	265	199	133
44	0.438		203.77	767	697	627	502	418	348	279	209	139
44	0.469		218.04	821	746	672	537	448	373	298	224	149
44	0.476		221.26	833	757	682	545	454	379	303	227	151
44	0.500	XS	232.29	875	795	716	573	477	398	318	239	159
44	0.513		238.25	898	816	735	588	490	408	326	245	163
44	0.556		257.97	973	885	796	637	531	442	354	265	177
44	0.562		260.72	984	894	805	644	536	447	358	268	179
44	0.625		289.52	1094	994	895	716	597	497	398	298	199
44	0.688		318.25	1204	1095	985	788	657	547	438	328	219

EXHIBIT B
(16 of 72)

YIELD 35,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
44	0.750		346.43	1313	1193	1074	859	716	597	477	358	239
44	0.812		374.53	1421	1292	1163	930	775	646	517	388	258
44	0.875		403.00	1531	1392	1253	1002	835	696	557	418	278
44	1.000		459.23	1750	1591	1432	1145	955	795	636	477	318
46	0.312		152.24	522	475	427	342	285	237	190	142	95
46	0.334		162.89	559	508	457	366	305	254	203	152	102
46	0.344		167.73	576	523	471	377	314	262	209	157	105
46	0.370		180.31	619	563	507	405	338	282	225	169	113
46	0.375	STD	182.73	628	571	514	411	342	285	228	171	114
46	0.406		197.70	680	618	556	445	371	309	247	185	124
46	0.417		203.00	698	635	571	457	381	317	254	190	127
46	0.438		213.13	733	667	600	480	400	333	267	200	133
46	0.469		228.06	785	714	642	514	428	357	285	214	143
46	0.476		231.43	797	724	652	522	435	362	290	217	145
46	0.500	XS	242.97	837	761	685	548	457	380	304	228	152
46	0.513		249.21	859	781	703	562	468	390	312	234	156
46	0.556		269.85	931	846	761	609	508	423	338	254	169
46	0.562		272.72	941	855	770	616	513	428	342	257	171
46	0.625		302.87	1046	951	856	685	571	476	380	285	190
46	0.688		332.94	1152	1047	942	754	628	523	419	314	209
46	0.750		362.45	1255	1141	1027	822	685	571	457	342	228
46	0.812		391.87	1359	1236	1112	890	741	618	494	371	247
46	0.875		421.69	1465	1332	1198	959	799	666	533	399	266
46	1.000		480.59	1674	1522	1370	1096	913	761	609	457	304
48	0.312		158.90	501	455	410	328	273	228	182	137	91
48	0.334		170.03	536	487	438	351	292	244	195	146	97
48	0.344		175.08	552	502	452	361	301	251	201	151	100
48	0.370		188.21	594	540	486	389	324	270	216	162	108
48	0.375	STD	190.74	602	547	492	394	328	273	219	164	109
48	0.406		206.37	651	592	533	426	355	296	237	178	118
48	0.417		211.91	669	608	547	438	365	304	243	182	122
48	0.438		222.48	703	639	575	460	383	319	256	192	128
48	0.469		238.08	752	684	616	492	410	342	274	205	137
48	0.476		241.59	764	694	625	500	417	347	278	208	139
48	0.500	XS	253.65	802	729	656	525	438	365	292	219	146
48	0.513		260.17	823	748	673	539	449	374	299	224	150
48	0.556		281.72	892	811	730	584	487	405	324	243	162
48	0.562		284.73	902	820	738	590	492	410	328	246	164
48	0.625		316.22	1003	911	820	656	547	456	365	273	182
48	0.688		347.64	1104	1003	903	722	602	502	401	301	201
48	0.750		378.47	1203	1094	984	788	656	547	438	328	219
48	0.812		409.22	1303	1184	1066	853	711	592	474	355	237
48	0.875		440.38	1404	1276	1148	919	766	638	510	383	255
48	1.000		501.95	1604	1458	1313	1050	875	729	583	438	292

EXHIBIT B
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YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
2	0.154	STD - 40	3.65	5991	5447	4902	3922	3268	2723	2179	1634	1089
2	0.218	XS - 80	5.02	8481	7710	6939	5551	4626	3855	3084	2313	1542
2	0.250		5.67	9726	8842	7958	6366	5305	4421	3537	2653	1768
2	0.344	160	7.46	13383	12167	10950	8760	7300	6083	4867	3650	2433
2	0.436	XXS	9.03	16963	15421	13879	11103	9252	7710	6168	4626	3084
3	0.125		4.51	3300	3000	2700	2160	1800	1500	1200	900	600
3	0.156		5.57	4118	3744	3370	2696	2246	1872	1498	1123	749
3	0.188		6.65	4963	4512	4061	3249	2707	2256	1805	1354	902
3	0.216	STD - 40	7.58	5702	5184	4666	3732	3110	2592	2074	1555	1037
3	0.250		8.68	6600	6000	5400	4320	3600	3000	2400	1800	1200
3	0.281		9.66	7418	6744	6070	4856	4046	3372	2698	2023	1349
3	0.300	XS - 80	10.25	7920	7200	6480	5184	4320	3600	2880	2160	1440
3	0.438	160	14.32	11563	10512	9461	7569	6307	5256	4205	3154	2102
3	0.600	XXS	18.58	15840	14400	12960	10368	8640	7200	5760	4320	2880
4	0.125		5.84	2567	2333	2100	1680	1400	1167	933	700	467
4	0.141		6.56	2895	2632	2369	1895	1579	1316	1053	790	526
4	0.156		7.24	3203	2912	2621	2097	1747	1456	1165	874	582
4	0.172		7.95	3532	3211	2890	2312	1926	1605	1284	963	642
4	0.188		8.66	3860	3509	3158	2527	2106	1755	1404	1053	702
4	0.203		9.32	4168	3789	3410	2728	2274	1895	1516	1137	758
4	0.219		10.01	4497	4088	3679	2943	2453	2044	1635	1226	818
4	0.237	STD - 40	10.79	4866	4424	3982	3185	2654	2212	1770	1327	885
4	0.250		11.35	5133	4667	4200	3360	2800	2333	1867	1400	933
4	0.281		12.66	5770	5245	4721	3777	3147	2623	2098	1574	1049
4	0.312		13.95	6406	5824	5242	4193	3494	2912	2330	1747	1165
4	0.337	XS - 80	14.98	6920	6291	5662	4529	3774	3145	2516	1887	1258
4	0.438	120	19.00	8994	8176	7358	5887	4906	4088	3270	2453	1635
4	0.500		21.36	10267	9333	8400	6720	5600	4667	3733	2800	1867
4	0.531	160	22.51	10903	9912	8921	7137	5947	4956	3965	2974	1982
4	0.674	XXS	27.54	13839	12581	11323	9059	7549	6291	5033	3774	2516
5	0.156		9.01	2591	2356	2120	1696	1413	1178	942	707	471
5	0.188		10.79	3123	2839	2555	2044	1703	1419	1136	852	568
5	0.219		12.50	3638	3307	2976	2381	1984	1653	1323	992	661
5	0.258	STD - 40	14.62	4285	3896	3506	2805	2337	1948	1558	1169	779
5	0.281		15.85	4667	4243	3819	3055	2546	2122	1697	1273	849
5	0.312		17.50	5182	4711	4240	3392	2827	2356	1884	1413	942
5	0.344		19.17	5714	5194	4675	3740	3117	2597	2078	1558	1039
5	0.375	XS - 80	20.78	6229	5662	5096	4077	3397	2831	2265	1699	1132
5	0.500	120	27.04	8305	7550	6795	5436	4530	3775	3020	2265	1510
5	0.625	160	32.96	10381	9437	8494	6795	5662	4719	3775	2831	1887
5	0.750	XXS	38.55	12457	11325	10192	8154	6795	5662	4530	3397	2265
6	0.156		10.78	2176	1978	1780	1424	1187	989	791	593	396
6	0.172		11.85	2399	2181	1963	1570	1308	1090	872	654	436
6	0.188		12.92	2622	2384	2145	1716	1430	1192	953	715	477
6	0.203		13.92	2831	2574	2316	1853	1544	1287	1030	772	515
6	0.219		14.98	3054	2777	2499	1999	1666	1388	1111	833	555
6	0.250		17.02	3487	3170	2853	2282	1902	1585	1268	951	634
6	0.277		18.78	3863	3512	3161	2529	2107	1756	1405	1054	702
6	0.280	STD - 40	18.97	3905	3550	3195	2556	2130	1775	1420	1065	710
6	0.312		21.04	4352	3956	3560	2848	2374	1978	1582	1187	791
6	0.344		23.08	4798	4362	3925	3140	2617	2181	1745	1308	872
6	0.375		25.03	5230	4755	4279	3423	2853	2377	1902	1426	951
6	0.432	XS - 80	28.57	6025	5477	4930	3944	3286	2739	2191	1643	1095
6	0.500		32.71	6974	6340	5706	4565	3804	3170	2536	1902	1268
6	0.562	120	36.39	7838	7126	6413	5131	4275	3563	2850	2138	1425
6	0.625		40.05	8717	7925	7132	5706	4755	3962	3170	2377	1585

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 33 of 87

EXHIBIT B
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YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
6	0.719	160	45.35	10028	9116	8205	6564	5470	4558	3647	2735	1823
6	0.864	XXS	53.16	12050	10955	9859	7888	6573	5477	4382	3286	2191
8	0.172		15.53	1843	1675	1508	1206	1005	838	670	503	335
8	0.188		16.94	2014	1831	1648	1318	1099	915	732	549	366
8	0.203		18.26	2175	1977	1779	1423	1186	989	791	593	395
8	0.219		19.66	2346	2133	1920	1536	1280	1066	853	640	427
8	0.250		22.36	2678	2435	2191	1753	1461	1217	974	730	487
8	0.277		24.70	2968	2698	2428	1942	1619	1349	1079	809	540
8	0.312		27.70	3342	3039	2735	2188	1823	1519	1215	912	608
8	0.322	STD - 40	28.55	3450	3136	2822	2258	1882	1568	1254	941	627
8	0.344		30.42	3685	3350	3015	2412	2010	1675	1340	1005	670
8	0.375		33.04	4017	3652	3287	2630	2191	1826	1461	1096	730
8	0.406		35.64	4349	3954	3559	2847	2372	1977	1582	1186	791
8	0.438		38.30	4692	4266	3839	3071	2559	2133	1706	1280	853
8	0.500	XS - 80	43.39	5357	4870	4383	3506	2922	2435	1948	1461	974
8	0.562		48.39	6021	5473	4926	3941	3284	2737	2189	1642	1095
8	0.594		50.95	6364	5785	5207	4165	3471	2893	2314	1736	1157
8	0.625		53.40	6696	6087	5478	4383	3652	3043	2435	1826	1217
8	0.719	120	60.71	7703	7002	6302	5042	4201	3501	2801	2101	1400
8	0.812		67.75	8699	7908	7117	5694	4745	3954	3163	2372	1582
8	0.875	XXS	72.42	9374	8522	7670	6136	5113	4261	3409	2557	1704
8	0.906	160	74.69	9706	8824	7941	6353	5294	4412	3529	2647	1765
10	0.188		21.21	1616	1469	1322	1058	881	735	588	441	294
10	0.203		22.87	1745	1586	1428	1142	952	793	634	476	317
10	0.219		24.63	1882	1711	1540	1232	1027	856	685	513	342
10	0.250		28.03	2149	1953	1758	1407	1172	977	781	586	391
10	0.279		31.20	2398	2180	1962	1570	1308	1090	872	654	436
10	0.307		34.24	2639	2399	2159	1727	1439	1199	960	720	480
10	0.344		38.23	2957	2688	2419	1935	1613	1344	1075	806	538
10	0.365	STD - 40	40.48	3137	2852	2567	2054	1711	1426	1141	856	570
10	0.438		48.24	3765	3423	3080	2464	2054	1711	1369	1027	685
10	0.500	XS	54.73	4298	3907	3516	2813	2344	1953	1563	1172	781
10	0.562		61.15	4831	4391	3952	3162	2635	2196	1757	1317	878
10	0.594	80	64.43	5106	4641	4177	3342	2785	2321	1857	1392	928
10	0.625		67.58	5372	4884	4395	3516	2930	2442	1953	1465	977
10	0.719		77.03	6180	5618	5056	4045	3371	2809	2247	1685	1124
10	0.750		80.10	6447	5860	5274	4220	3516	2930	2344	1758	1172
10	0.812		86.18	6979	6345	5710	4568	3807	3172	2538	1903	1269
10	0.844	120	89.29	7254	6595	5935	4748	3957	3297	2638	1978	1319
10	0.875		92.28	7521	6837	6153	4923	4102	3419	2735	2051	1367
10	1.000	XXS	104.13	8595	7814	7033	5626	4688	3907	3126	2344	1563
12	0.203		27.20	1471	1337	1204	963	802	669	535	401	267
12	0.219		29.31	1587	1443	1299	1039	866	721	577	433	289
12	0.250		33.37	1812	1647	1482	1186	988	824	659	494	329
12	0.281		37.42	2036	1851	1666	1333	1111	926	741	555	370
12	0.312		41.44	2261	2056	1850	1480	1233	1028	822	617	411
12	0.330		43.77	2392	2174	1957	1565	1304	1087	870	652	435
12	0.344		45.58	2493	2266	2040	1632	1360	1133	907	680	453
12	0.375	STD	49.56	2718	2471	2224	1779	1482	1235	988	741	494
12	0.406	40	53.52	2942	2675	2407	1926	1605	1337	1070	802	535
12	0.438		57.59	3174	2886	2597	2078	1731	1443	1154	866	577
12	0.500	XS	65.41	3624	3294	2965	2372	1976	1647	1318	988	659
12	0.562		73.15	4073	3703	3332	2666	2222	1851	1481	1111	741
12	0.625		80.93	4529	4118	3706	2965	2471	2059	1647	1235	824
12	0.688	80	88.63	4986	4533	4079	3264	2720	2266	1813	1360	907
12	0.750		96.12	5435	4941	4447	3558	2965	2471	1976	1482	988
12	0.844		107.32	6117	5560	5004	4004	3336	2780	2224	1668	1112

EXHIBIT B
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YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
12	0.875		110.97	6341	5765	5188	4151	3459	2882	2306	1729	1153
12	1.000	XXS - 120	125.49	7247	6588	5929	4744	3953	3294	2635	1976	1318
14	0.210		30.93	1386	1260	1134	907	756	630	504	378	252
14	0.219		32.23	1445	1314	1183	946	788	657	526	394	263
14	0.250		36.71	1650	1500	1350	1080	900	750	600	450	300
14	0.281		41.17	1855	1686	1517	1214	1012	843	674	506	337
14	0.312		45.61	2059	1872	1685	1348	1123	936	749	562	374
14	0.344		50.17	2270	2064	1858	1486	1238	1032	826	619	413
14	0.375	STD	54.57	2475	2250	2025	1620	1350	1125	900	675	450
14	0.438	40	63.44	2891	2628	2365	1892	1577	1314	1051	788	526
14	0.469		67.77	3095	2814	2533	2026	1688	1407	1126	844	563
14	0.500	XS	72.09	3300	3000	2700	2160	1800	1500	1200	900	600
14	0.562		80.66	3709	3372	3035	2428	2023	1686	1349	1012	674
14	0.594		85.05	3920	3564	3208	2566	2138	1782	1426	1069	713
14	0.625		89.28	4125	3750	3375	2700	2250	1875	1500	1125	750
14	0.688		97.81	4541	4128	3715	2972	2477	2064	1651	1238	826
14	0.750	80	106.13	4950	4500	4050	3240	2700	2250	1800	1350	900
14	0.812		114.37	5359	4872	4385	3508	2923	2436	1949	1462	974
16	0.219		36.91	1265	1150	1035	828	690	575	460	345	230
16	0.250		42.05	1444	1313	1181	945	788	656	525	394	263
16	0.281		47.17	1623	1475	1328	1062	885	738	590	443	295
16	0.312		52.27	1802	1638	1474	1179	983	819	655	491	328
16	0.344		57.52	1987	1806	1625	1300	1084	903	722	542	361
16	0.375	STD	62.58	2166	1969	1772	1418	1181	984	788	591	394
16	0.438		72.80	2529	2300	2070	1656	1380	1150	920	690	460
16	0.469		77.79	2708	2462	2216	1773	1477	1231	985	739	492
16	0.500	XXS - 40	82.77	2888	2625	2363	1890	1575	1313	1050	788	525
16	0.562		92.66	3246	2951	2655	2124	1770	1475	1180	885	590
16	0.625		102.63	3609	3281	2953	2363	1969	1641	1313	984	656
16	0.656		107.50	3788	3444	3100	2480	2066	1722	1378	1033	689
16	0.688		112.51	3973	3612	3251	2601	2167	1806	1445	1084	722
16	0.750		122.15	4331	3938	3544	2835	2363	1969	1575	1181	788
16	0.812		131.71	4689	4263	3837	3069	2558	2132	1705	1279	853
16	0.844	80	136.61	4874	4431	3988	3190	2659	2216	1772	1329	886
16	1.000		160.20	5775	5250	4725	3780	3150	2625	2100	1575	1050
18	0.250		47.39	1283	1167	1050	840	700	583	467	350	233
18	0.281		53.18	1442	1311	1180	944	787	656	525	393	262
18	0.312		58.94	1602	1456	1310	1048	874	728	582	437	291
18	0.344		64.87	1766	1605	1445	1156	963	803	642	482	321
18	0.375	STD	70.59	1925	1750	1575	1260	1050	875	700	525	350
18	0.406		76.29	2084	1895	1705	1364	1137	947	758	568	379
18	0.438		82.15	2248	2044	1840	1472	1226	1022	818	613	409
18	0.469		87.81	2408	2189	1970	1576	1313	1094	875	657	438
18	0.500	XS	93.45	2567	2333	2100	1680	1400	1167	933	700	467
18	0.562	40	104.66	2885	2623	2360	1888	1574	1311	1049	787	525
18	0.625		115.98	3208	2917	2625	2100	1750	1458	1167	875	583
18	0.688		127.20	3532	3211	2890	2312	1926	1605	1284	963	642
18	0.750		138.17	3850	3500	3150	2520	2100	1750	1400	1050	700
18	0.812		149.05	4168	3789	3410	2728	2274	1895	1516	1137	758
18	0.938	80	170.92	4815	4377	3940	3152	2626	2189	1751	1313	875
18	1.000		181.56	5133	4667	4200	3360	2800	2333	1867	1400	933
20	0.250		52.73	1155	1050	945	756	630	525	420	315	210
20	0.278		58.55	1284	1168	1051	841	701	584	467	350	234
20	0.281		59.18	1298	1180	1062	850	708	590	472	354	236
20	0.312		65.60	1441	1310	1179	943	786	655	524	393	262
20	0.334		70.15	1543	1403	1263	1010	842	701	561	421	281

EXHIBIT B
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YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
20	0.344		72.21	1589	1445	1300	1040	867	722	578	433	289
20	0.347		72.83	1603	1457	1312	1049	874	729	583	437	291
20	0.375	STD	78.60	1733	1575	1418	1134	945	788	630	473	315
20	0.406		84.96	1876	1705	1535	1228	1023	853	682	512	341
20	0.417		87.21	1927	1751	1576	1261	1051	876	701	525	350
20	0.438		91.51	2024	1840	1656	1325	1104	920	736	552	368
20	0.462		96.40	2134	1940	1746	1397	1164	970	776	582	388
20	0.469		97.83	2167	1970	1773	1418	1182	985	788	591	394
20	0.500	XS	104.13	2310	2100	1890	1512	1260	1050	840	630	420
20	0.562		116.67	2596	2360	2124	1699	1416	1180	944	708	472
20	0.594	40	123.11	2744	2495	2245	1796	1497	1247	998	748	499
20	0.625		129.33	2888	2625	2363	1890	1575	1313	1050	788	525
20	0.688		141.90	3179	2890	2601	2081	1734	1445	1156	867	578
20	0.750		154.19	3465	3150	2835	2268	1890	1575	1260	945	630
20	0.812		166.40	3751	3410	3069	2455	2046	1705	1364	1023	682
20	1.000		202.92	4620	4200	3780	3024	2520	2100	1680	1260	840
22	0.250		58.07	1050	955	859	687	573	477	382	286	191
22	0.281		65.18	1180	1073	966	772	644	536	429	322	215
22	0.312		72.27	1310	1191	1072	858	715	596	477	357	238
22	0.344		79.56	1445	1313	1182	946	788	657	525	394	263
22	0.375	STD	86.61	1575	1432	1289	1031	859	716	573	430	286
22	0.438		100.86	1840	1672	1505	1204	1003	836	669	502	334
22	0.500	XS	114.81	2100	1909	1718	1375	1145	955	764	573	382
22	0.562		128.67	2360	2146	1931	1545	1287	1073	858	644	429
22	0.625		142.68	2625	2386	2148	1718	1432	1193	955	716	477
22	0.688		156.59	2890	2627	2364	1891	1576	1313	1051	788	525
22	0.750		170.21	3150	2864	2577	2062	1718	1432	1145	859	573
22	0.812		183.74	3410	3100	2790	2232	1860	1550	1240	930	620
24	0.250		63.41	963	875	788	630	525	438	350	263	175
24	0.257		65.17	989	900	810	648	540	450	360	270	180
24	0.278		70.43	1070	973	876	701	584	487	389	292	195
24	0.281		71.18	1082	984	885	708	590	492	393	295	197
24	0.300		75.93	1155	1050	945	756	630	525	420	315	210
24	0.312		78.93	1201	1092	983	786	655	546	437	328	218
24	0.334		84.42	1286	1169	1052	842	701	585	468	351	234
24	0.344		86.91	1324	1204	1084	867	722	602	482	361	241
24	0.370		93.37	1425	1295	1166	932	777	648	518	389	259
24	0.375	STD	94.62	1444	1313	1181	945	788	656	525	394	263
24	0.406		102.30	1563	1421	1279	1023	853	711	568	426	284
24	0.420		105.77	1617	1470	1323	1058	882	735	588	441	294
24	0.438		110.22	1686	1533	1380	1104	920	767	613	460	307
24	0.469		117.86	1806	1642	1477	1182	985	821	657	492	328
24	0.500	XS	125.49	1925	1750	1575	1260	1050	875	700	525	350
24	0.562		140.68	2164	1967	1770	1416	1180	984	787	590	393
24	0.625		156.03	2406	2188	1969	1575	1313	1094	875	656	438
24	0.688	40	171.29	2649	2408	2167	1734	1445	1204	963	722	482
24	0.750		186.23	2888	2625	2363	1890	1575	1313	1050	788	525
24	0.812		201.09	3126	2842	2558	2046	1705	1421	1137	853	568
24	1.000		245.64	3850	3500	3150	2520	2100	1750	1400	1050	700
26	0.250		68.75	888	808	727	582	485	404	323	242	162
26	0.278		76.37	988	898	808	647	539	449	359	269	180
26	0.281		77.18	999	908	817	654	545	454	363	272	182
26	0.301		82.61	1070	972	875	700	583	486	389	292	194
26	0.312		85.60	1109	1008	907	726	605	504	403	302	202
26	0.334		91.55	1187	1079	971	777	647	540	432	324	216
26	0.344		94.26	1223	1111	1000	800	667	556	445	333	222
26	0.361		98.85	1283	1166	1050	840	700	583	467	350	233

EXHIBIT B
(21 of 72)

YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
26	0.375	STD	102.63	1333	1212	1090	872	727	606	485	363	242
26	0.406		110.98	1443	1312	1181	944	787	656	525	394	262
26	0.438		119.57	1557	1415	1274	1019	849	708	566	425	283
26	0.469		127.88	1667	1515	1364	1091	909	758	606	455	303
26	0.500	XS	136.17	1777	1615	1454	1163	969	808	646	485	323
26	0.562		152.68	1997	1816	1634	1307	1089	908	726	545	363
26	0.625		169.38	2221	2019	1817	1454	1212	1010	808	606	404
26	0.688		185.99	2445	2223	2000	1600	1334	1111	889	667	445
26	0.750		202.25	2665	2423	2181	1745	1454	1212	969	727	485
26	0.875		234.79	3110	2827	2544	2035	1696	1413	1131	848	565
26	1.000		267.00	3554	3231	2908	2326	1938	1615	1292	969	646
28	0.250		74.09	825	750	675	540	450	375	300	225	150
28	0.281		83.19	927	843	759	607	506	422	337	253	169
28	0.312		92.26	1030	936	842	674	562	468	374	281	187
28	0.344		101.60	1135	1032	929	743	619	516	413	310	206
28	0.375	STD	110.64	1238	1125	1013	810	675	563	450	338	225
28	0.406		119.65	1340	1218	1096	877	731	609	487	365	244
28	0.438		128.93	1445	1314	1183	946	788	657	526	394	263
28	0.469		137.90	1548	1407	1266	1013	844	704	563	422	281
28	0.500	XS	146.85	1650	1500	1350	1080	900	750	600	450	300
28	0.562		164.68	1855	1686	1517	1214	1012	843	674	506	337
28	0.625		182.73	2063	1875	1688	1350	1125	938	750	563	375
30	0.281		89.19	865	787	708	566	472	393	315	236	157
30	0.300		95.16	924	840	756	605	504	420	336	252	168
30	0.312		98.92	961	874	786	629	524	437	349	262	175
30	0.321		101.75	989	899	809	647	539	449	360	270	180
30	0.323		102.37	995	904	814	651	543	452	362	271	181
30	0.325		103.00	1001	910	819	655	546	455	364	273	182
30	0.344		108.95	1060	963	867	694	578	482	385	289	193
30	0.347		109.89	1069	972	874	700	583	486	389	291	194
30	0.360		113.96	1109	1008	907	726	605	504	403	302	202
30	0.375	STD	118.65	1155	1050	945	756	630	525	420	315	210
30	0.385		121.77	1186	1078	970	776	647	539	431	323	216
30	0.400		126.45	1232	1120	1008	806	672	560	448	336	224
30	0.406		128.32	1250	1137	1023	818	682	568	455	341	227
30	0.417		131.75	1284	1168	1051	841	701	584	467	350	234
30	0.420		132.68	1294	1176	1058	847	706	588	470	353	235
30	0.422		133.30	1300	1182	1063	851	709	591	473	354	236
30	0.438		138.28	1349	1226	1104	883	736	613	491	368	245
30	0.469		147.92	1445	1313	1182	946	788	657	525	394	263
30	0.480		151.33	1478	1344	1210	968	806	672	538	403	269
30	0.500	XS	157.53	1540	1400	1260	1008	840	700	560	420	280
30	0.504		158.77	1552	1411	1270	1016	847	706	564	423	282
30	0.525		165.26	1617	1470	1323	1058	882	735	588	441	294
30	0.530		166.81	1632	1484	1336	1068	890	742	594	445	297
30	0.562		176.69	1731	1574	1416	1133	944	787	629	472	315
30	0.563		177.00	1734	1576	1419	1135	946	788	631	473	315
30	0.625		196.08	1925	1750	1575	1260	1050	875	700	525	350
30	0.750		234.29	2310	2100	1890	1512	1260	1050	840	630	420
30	0.875		272.17	2695	2450	2205	1764	1470	1225	980	735	490
30	1.000		309.72	3080	2800	2520	2016	1680	1400	1120	840	560
30.2	0.423		134.52	1294	1177	1059	847	706	588	471	353	235
32	0.250		84.77	722	656	591	473	394	328	263	197	131
32	0.281		95.19	811	738	664	531	443	369	295	221	148
32	0.312		105.59	901	819	737	590	491	410	328	246	164
32	0.344		116.30	993	903	813	650	542	452	361	271	181

EXHIBIT B
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YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
32	0.375	STD	126.66	1083	984	886	709	591	492	394	295	197
32	0.406		136.99	1172	1066	959	767	639	533	426	320	213
32	0.438		147.64	1265	1150	1035	828	690	575	460	345	230
32	0.469		157.93	1354	1231	1108	886	739	616	492	369	246
32	0.500	XS	168.21	1444	1313	1181	945	788	656	525	394	263
32	0.562		188.69	1623	1475	1328	1062	885	738	590	443	295
32	0.625		209.43	1805	1641	1477	1181	984	820	656	492	328
34	0.250		90.11	679	618	556	445	371	309	247	185	124
34	0.281		101.19	764	694	625	500	417	347	278	208	139
34	0.312		112.25	848	771	694	555	462	385	308	231	154
34	0.344		123.65	935	850	765	612	510	425	340	255	170
34	0.375	STD	134.67	1019	926	834	667	556	463	371	278	185
34	0.406		145.66	1103	1003	903	722	602	502	401	301	201
34	0.438		157.00	1190	1082	974	779	649	541	433	325	216
34	0.469		167.95	1275	1159	1043	834	695	579	463	348	232
34	0.500	XS	178.89	1359	1235	1112	889	741	618	494	371	247
34	0.562		200.70	1527	1388	1250	1000	833	694	555	417	278
34	0.625		222.77	1699	1544	1390	1112	926	772	618	463	309
36	0.312		118.92	801	728	655	524	437	364	291	218	146
36	0.344		131.00	883	803	722	578	482	401	321	241	161
36	0.356		135.52	914	831	748	598	498	415	332	249	166
36	0.375	STD	142.68	963	875	788	630	525	438	350	263	175
36	0.385		146.44	988	898	809	647	539	449	359	270	180
36	0.388		147.57	996	905	815	652	543	453	362	272	181
36	0.406		154.34	1042	947	853	682	568	474	379	284	189
36	0.417		158.47	1070	973	876	701	584	487	389	292	195
36	0.438		166.35	1124	1022	920	736	613	511	409	307	204
36	0.450		170.85	1155	1050	945	756	630	525	420	315	210
36	0.469		177.97	1204	1094	985	788	657	547	438	328	219
36	0.500	XS	189.57	1283	1167	1050	840	700	583	467	350	233
36	0.504		191.06	1294	1176	1058	847	706	588	470	353	235
36	0.525		198.91	1348	1225	1103	882	735	613	490	368	245
36	0.540		204.50	1386	1260	1134	907	756	630	504	378	252
36	0.562		212.70	1442	1311	1180	944	787	656	525	393	262
36	0.600		226.84	1540	1400	1260	1008	840	700	560	420	280
36	0.605		228.70	1553	1412	1271	1016	847	706	565	424	282
36	0.625		236.12	1604	1458	1313	1050	875	729	583	438	292
36	0.660		249.10	1694	1540	1386	1109	924	770	616	462	308
36	0.688		259.46	1766	1605	1445	1156	963	803	642	482	321
36	0.750		282.35	1925	1750	1575	1260	1050	875	700	525	350
36	0.875		328.24	2246	2042	1838	1470	1225	1021	817	613	408
36	1.000		373.79	2567	2333	2100	1680	1400	1167	933	700	467
36.24	0.508		193.86	1295	1177	1060	848	706	589	471	353	235
38	0.312		125.58	759	690	621	497	414	345	276	207	138
38	0.344		138.34	836	760	684	548	456	380	304	228	152
38	0.375	STD	150.69	912	829	746	597	497	414	332	249	166
38	0.406		163.01	987	897	808	646	538	449	359	269	179
38	0.438		175.71	1065	968	871	697	581	484	387	290	194
38	0.469		187.99	1140	1037	933	746	622	518	415	311	207
38	0.500	XS	200.25	1216	1105	995	796	663	553	442	332	221
38	0.562		224.71	1367	1242	1118	894	745	621	497	373	248
38	0.625		249.47	1520	1382	1243	995	829	691	553	414	276
40	0.344		145.69	795	722	650	520	433	361	289	217	144
40	0.375	STD	158.70	866	788	709	567	473	394	315	236	158
40	0.406		171.68	938	853	767	614	512	426	341	256	171

EXHIBIT B
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YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
40	0.438		185.06	1012	920	828	662	552	460	368	276	184
40	0.469		198.00	1083	985	886	709	591	492	394	295	197
40	0.500	XS	210.93	1155	1050	945	756	630	525	420	315	210
40	0.562		236.71	1298	1180	1062	850	708	590	472	354	236
40	0.625		262.82	1444	1313	1181	945	788	656	525	394	263
42	0.312		138.91	686	624	562	449	374	312	250	187	125
42	0.323		143.77	711	646	581	465	388	323	258	194	129
42	0.344		153.04	757	688	619	495	413	344	275	206	138
42	0.363		161.42	799	726	653	523	436	363	290	218	145
42	0.375	STD	166.71	825	750	675	540	450	375	300	225	150
42	0.406		180.35	893	812	731	585	487	406	325	244	162
42	0.417		185.19	917	834	751	600	500	417	334	250	167
42	0.438		194.42	964	876	788	631	526	438	350	263	175
42	0.450		199.69	990	900	810	648	540	450	360	270	180
42	0.469		208.02	1032	938	844	675	563	469	375	281	188
42	0.486		215.47	1069	972	875	700	583	486	389	292	194
42	0.500	XS	221.61	1100	1000	900	720	600	500	400	300	200
42	0.562		248.71	1236	1124	1012	809	674	562	450	337	225
42	0.625		276.17	1375	1250	1125	900	750	625	500	375	250
42	0.688		303.55	1514	1376	1238	991	826	688	550	413	275
42	0.750		330.41	1650	1500	1350	1080	900	750	600	450	300
42	0.812		357.18	1786	1624	1462	1169	974	812	650	487	325
42	0.875		384.31	1925	1750	1575	1260	1050	875	700	525	350
42	1.000		437.87	2200	2000	1800	1440	1200	1000	800	600	400
44	0.312		145.57	655	596	536	429	357	298	238	179	119
44	0.334		155.76	701	638	574	459	383	319	255	191	128
44	0.344		160.39	722	657	591	473	394	328	263	197	131
44	0.370		172.41	777	706	636	509	424	353	283	212	141
44	0.375	STD	174.72	788	716	644	515	430	358	286	215	143
44	0.406		189.02	853	775	698	558	465	388	310	233	155
44	0.417		194.10	876	796	716	573	478	398	318	239	159
44	0.438		203.77	920	836	753	602	502	418	334	251	167
44	0.469		218.04	985	895	806	645	537	448	358	269	179
44	0.476		221.26	1000	909	818	654	545	454	363	273	182
44	0.500	XS	232.29	1050	955	859	687	573	477	382	286	191
44	0.513		238.25	1077	979	881	705	588	490	392	294	196
44	0.556		257.97	1168	1061	955	764	637	531	425	318	212
44	0.562		260.72	1180	1073	966	772	644	536	429	322	215
44	0.625		289.52	1313	1193	1074	859	716	597	477	358	239
44	0.688		318.25	1445	1313	1182	946	788	657	525	394	263
44	0.750		346.43	1575	1432	1289	1031	859	716	573	430	286
44	0.812		374.53	1705	1550	1395	1116	930	775	620	465	310
44	0.875		403.00	1838	1670	1503	1203	1002	835	668	501	334
44	1.000		459.23	2100	1909	1718	1375	1145	955	764	573	382
46	0.312		152.24	627	570	513	410	342	285	228	171	114
46	0.334		162.89	671	610	549	439	366	305	244	183	122
46	0.344		167.73	691	628	565	452	377	314	251	188	126
46	0.370		180.31	743	676	608	486	405	338	270	203	135
46	0.375	STD	182.73	753	685	616	493	411	342	274	205	137
46	0.406		197.70	816	741	667	534	445	371	297	222	148
46	0.417		203.00	838	761	685	548	457	381	305	228	152
46	0.438		213.13	880	800	720	576	480	400	320	240	160
46	0.469		228.06	942	856	771	617	514	428	343	257	171
46	0.476		231.43	956	869	782	626	522	435	348	261	174
46	0.500	XS	242.97	1004	913	822	657	548	457	365	274	183
46	0.513		249.21	1030	937	843	674	562	468	375	281	187
46	0.556		269.85	1117	1015	914	731	609	508	406	305	203

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 39 of 87

EXHIBIT B
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YIELD 42,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
46	0.562		272.72	1129	1026	924	739	616	513	411	308	205
46	0.625		302.87	1255	1141	1027	822	685	571	457	342	228
46	0.688		332.94	1382	1256	1131	905	754	628	503	377	251
46	0.750		362.45	1507	1370	1233	986	822	685	548	411	274
46	0.812		391.87	1631	1483	1335	1068	890	741	593	445	297
46	0.875		421.69	1758	1598	1438	1150	959	799	639	479	320
46	1.000		480.59	2009	1826	1643	1315	1096	913	730	548	365
48	0.312		158.90	601	546	491	393	328	273	218	164	109
48	0.334		170.03	643	585	526	421	351	292	234	175	117
48	0.344		175.08	662	602	542	433	361	301	241	181	120
48	0.370		188.21	712	648	583	466	389	324	259	194	130
48	0.375	STD	190.74	722	656	591	473	394	328	263	197	131
48	0.406		206.37	782	711	639	512	426	355	284	213	142
48	0.417		211.91	803	730	657	525	438	365	292	219	146
48	0.438		222.48	843	767	690	552	460	383	307	230	153
48	0.469		238.08	903	821	739	591	492	410	328	246	164
48	0.476		241.59	916	833	750	600	500	417	333	250	167
48	0.500	XS	253.65	963	875	788	630	525	438	350	263	175
48	0.513		260.17	988	898	808	646	539	449	359	269	180
48	0.556		281.72	1070	973	876	701	584	487	389	292	195
48	0.562		284.73	1082	984	885	708	590	492	393	295	197
48	0.625		316.22	1203	1094	984	788	656	547	438	328	219
48	0.688		347.64	1324	1204	1084	867	722	602	482	361	241
48	0.750		378.47	1444	1313	1181	945	788	656	525	394	263
48	0.812		409.22	1563	1421	1279	1023	853	711	568	426	284
48	0.875		440.38	1684	1531	1378	1103	919	766	613	459	306
48	1.000		501.95	1925	1750	1575	1260	1050	875	700	525	350

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 40 of 87

EXHIBIT B
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YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
2	0.154	STD - 40	3.65	6562	5965	5369	4295	3579	2983	2386	1790	1193
2	0.218	XS - 80	5.02	9289	8445	7600	6080	5067	4222	3378	2533	1689
2	0.250		5.67	10653	9684	8716	6973	5811	4842	3874	2905	1937
2	0.344	160	7.46	14658	13325	11993	9594	7995	6663	5330	3998	2665
2	0.436	XXS	9.03	18578	16889	15200	12160	10134	8445	6756	5067	3378
3	0.125		4.51	3614	3286	2957	2366	1971	1643	1314	986	657
3	0.156		5.57	4511	4101	3691	2952	2460	2050	1640	1230	820
3	0.188		6.65	5436	4942	4448	3558	2965	2471	1977	1483	988
3	0.216	STD - 40	7.58	6245	5678	5110	4088	3407	2839	2271	1703	1136
3	0.250		8.68	7229	6571	5914	4731	3943	3286	2629	1971	1314
3	0.281		9.66	8125	7386	6648	5318	4432	3693	2955	2216	1477
3	0.300	XS - 80	10.25	8674	7886	7097	5678	4731	3943	3154	2366	1577
3	0.438	160	14.32	12664	11513	10362	8289	6908	5757	4605	3454	2303
3	0.600	XXS	18.58	17349	15771	14194	11355	9463	7886	6309	4731	3154
4	0.125		5.84	2811	2556	2300	1840	1533	1278	1022	767	511
4	0.141		6.56	3171	2883	2594	2076	1730	1441	1153	865	577
4	0.156		7.24	3508	3189	2870	2296	1914	1595	1276	957	638
4	0.172		7.95	3868	3516	3165	2532	2110	1758	1407	1055	703
4	0.188		8.66	4228	3844	3459	2767	2306	1922	1537	1153	769
4	0.203		9.32	4565	4150	3735	2988	2490	2075	1660	1245	830
4	0.219		10.01	4925	4477	4030	3224	2686	2239	1791	1343	895
4	0.237	STD - 40	10.79	5330	4845	4361	3489	2907	2423	1938	1454	969
4	0.250		11.35	5622	5111	4600	3680	3067	2556	2044	1533	1022
4	0.281		12.66	6319	5745	5170	4136	3447	2872	2298	1723	1149
4	0.312		13.95	7017	6379	5741	4593	3827	3189	2551	1914	1276
4	0.337	XS - 80	14.98	7579	6890	6201	4961	4134	3445	2756	2067	1378
4	0.438	120	19.00	9850	8955	8059	6447	5373	4477	3582	2686	1791
4	0.500		21.36	11244	10222	9200	7360	6133	5111	4089	3067	2044
4	0.531	160	22.51	11942	10856	9770	7816	6514	5428	4342	3257	2171
4	0.674	XXS	27.54	15158	13780	12402	9921	8268	6890	5512	4134	2756
5	0.156		9.01	2838	2580	2322	1858	1548	1290	1032	774	516
5	0.188		10.79	3420	3109	2798	2239	1865	1555	1244	933	622
5	0.219		12.50	3984	3622	3260	2608	2173	1811	1449	1087	724
5	0.258	STD - 40	14.62	4693	4267	3840	3072	2560	2133	1707	1280	853
5	0.281		15.85	5112	4647	4182	3346	2788	2324	1859	1394	929
5	0.312		17.50	5676	5160	4644	3715	3096	2580	2064	1548	1032
5	0.344		19.17	6258	5689	5120	4096	3413	2845	2276	1707	1138
5	0.375	XS - 80	20.78	6822	6202	5582	4465	3721	3101	2481	1861	1240
5	0.500	120	27.04	9096	8269	7442	5954	4961	4134	3308	2481	1654
5	0.625	160	32.96	11370	10336	9303	7442	6202	5168	4134	3101	2067
5	0.750	XXS	38.55	13644	12403	11163	8930	7442	6202	4961	3721	2481
6	0.156		10.78	2383	2166	1950	1560	1300	1083	867	650	433
6	0.172		11.85	2627	2389	2150	1720	1433	1194	955	717	478
6	0.188		12.92	2872	2611	2350	1880	1566	1305	1044	783	522
6	0.203		13.92	3101	2819	2537	2030	1691	1410	1128	846	564
6	0.219		14.98	3345	3041	2737	2190	1825	1521	1216	912	608
6	0.250		17.02	3819	3472	3125	2500	2083	1736	1389	1042	694
6	0.277		18.78	4231	3847	3462	2770	2308	1923	1539	1154	769
6	0.280	STD - 40	18.97	4277	3888	3499	2800	2333	1944	1555	1166	778
6	0.312		21.04	4766	4333	3899	3120	2600	2166	1733	1300	867
6	0.344		23.08	5255	4777	4299	3439	2866	2389	1911	1433	955
6	0.375		25.03	5728	5208	4687	3749	3125	2604	2083	1562	1042
6	0.432	XS - 80	28.57	6599	5999	5399	4319	3599	3000	2400	1800	1200
6	0.500		32.71	7638	6943	6249	4999	4166	3472	2777	2083	1389
6	0.562	120	36.39	8585	7804	7024	5619	4683	3902	3122	2341	1561
6	0.625		40.05	9547	8679	7811	6249	5208	4340	3472	2604	1736

EXHIBIT B
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YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
6	0.719	160	45.35	10983	9985	8986	7189	5991	4992	3994	2995	1997
6	0.864	XXS	53.16	13198	11998	10798	8639	7199	5999	4799	3599	2400
8	0.172		15.53	2018	1835	1651	1321	1101	917	734	550	367
8	0.188		16.94	2206	2005	1805	1444	1203	1003	802	602	401
8	0.203		18.26	2382	2165	1949	1559	1299	1083	866	650	433
8	0.219		19.66	2570	2336	2102	1682	1402	1168	934	701	467
8	0.250		22.36	2933	2667	2400	1920	1600	1333	1067	800	533
8	0.277		24.70	3250	2955	2659	2127	1773	1477	1182	886	591
8	0.312		27.70	3661	3328	2995	2396	1997	1664	1331	998	666
8	0.322	STD - 40	28.55	3778	3435	3091	2473	2061	1717	1374	1030	687
8	0.344		30.42	4036	3669	3302	2642	2202	1835	1468	1101	734
8	0.375		33.04	4400	4000	3600	2880	2400	2000	1600	1200	800
8	0.406		35.64	4764	4331	3898	3118	2598	2165	1732	1299	866
8	0.438		38.30	5139	4672	4205	3364	2803	2336	1869	1402	934
8	0.500	XS - 80	43.39	5867	5333	4800	3840	3200	2667	2133	1600	1067
8	0.562		48.39	6594	5995	5395	4316	3597	2997	2398	1798	1199
8	0.594		50.95	6970	6336	5702	4562	3802	3168	2534	1901	1267
8	0.625		53.40	7333	6667	6000	4800	4000	3333	2667	2000	1333
8	0.719	120	60.71	8436	7669	6902	5522	4602	3835	3068	2301	1534
8	0.812		67.75	9527	8661	7795	6236	5197	4331	3465	2598	1732
8	0.875	XXS	72.42	10267	9333	8400	6720	5600	4667	3733	2800	1867
8	0.906	160	74.69	10630	9664	8698	6958	5798	4832	3866	2899	1933
10	0.188		21.21	1770	1609	1448	1158	965	804	644	483	322
10	0.203		22.87	1911	1737	1564	1251	1042	869	695	521	347
10	0.219		24.63	2062	1874	1687	1349	1125	937	750	562	375
10	0.250		28.03	2353	2140	1926	1540	1284	1070	856	642	428
10	0.279		31.20	2626	2388	2149	1719	1433	1194	955	716	478
10	0.307		34.24	2890	2627	2365	1892	1576	1314	1051	788	525
10	0.344		38.23	3238	2944	2650	2120	1766	1472	1178	883	589
10	0.365	STD - 40	40.48	3436	3124	2811	2249	1874	1562	1249	937	625
10	0.438		48.24	4123	3748	3374	2699	2249	1874	1499	1125	750
10	0.500	XS	54.73	4707	4279	3851	3081	2567	2140	1712	1284	856
10	0.562		61.15	5291	4810	4329	3463	2886	2405	1924	1443	962
10	0.594	80	64.43	5592	5084	4575	3660	3050	2542	2033	1525	1017
10	0.625		67.58	5884	5349	4814	3851	3209	2674	2140	1605	1070
10	0.719		77.03	6769	6153	5538	4430	3692	3077	2461	1846	1231
10	0.750		80.10	7060	6419	5777	4621	3851	3209	2567	1926	1284
10	0.812		86.18	7644	6949	6254	5003	4170	3475	2780	2085	1390
10	0.844	120	89.29	7945	7223	6501	5201	4334	3612	2889	2167	1445
10	0.875		92.28	8237	7488	6740	5392	4493	3744	2995	2247	1498
10	1.000	XXS	104.13	9414	8558	7702	6162	5135	4279	3423	2567	1712
12	0.203		27.20	1611	1465	1318	1055	879	732	586	439	293
12	0.219		29.31	1738	1580	1422	1138	948	790	632	474	316
12	0.250		33.37	1984	1804	1624	1299	1082	902	722	541	361
12	0.281		37.42	2230	2028	1825	1460	1217	1014	811	608	406
12	0.312		41.44	2476	2251	2026	1621	1351	1126	901	675	450
12	0.330		43.77	2619	2381	2143	1714	1429	1191	952	714	476
12	0.344		45.58	2730	2482	2234	1787	1489	1241	993	745	496
12	0.375	STD	49.56	2976	2706	2435	1948	1624	1353	1082	812	541
12	0.406	40	53.52	3223	2930	2637	2109	1758	1465	1172	879	586
12	0.438		57.59	3477	3160	2844	2276	1896	1580	1264	948	632
12	0.500	XS	65.41	3969	3608	3247	2598	2165	1804	1443	1082	722
12	0.562		73.15	4461	4055	3650	2920	2433	2028	1622	1217	811
12	0.625		80.93	4961	4510	4059	3247	2706	2255	1804	1353	902
12	0.688	80	88.63	5461	4964	4468	3574	2979	2482	1986	1489	993
12	0.750		96.12	5953	5412	4871	3896	3247	2706	2165	1624	1082
12	0.844		107.32	6699	6090	5481	4385	3654	3045	2436	1827	1218

EXHIBIT B
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YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
12	0.875		110.97	6945	6314	5682	4546	3788	3157	2525	1894	1263
12	1.000	XXS - 120	125.49	7937	7216	6494	5195	4329	3608	2886	2165	1443
14	0.210		30.93	1518	1380	1242	994	828	690	552	414	276
14	0.219		32.23	1583	1439	1295	1036	863	720	576	432	288
14	0.250		36.71	1807	1643	1479	1183	986	821	657	493	329
14	0.281		41.17	2031	1847	1662	1330	1108	923	739	554	369
14	0.312		45.61	2255	2050	1845	1476	1230	1025	820	615	410
14	0.344		50.17	2487	2261	2035	1628	1356	1130	904	678	452
14	0.375	STD	54.57	2711	2464	2218	1774	1479	1232	986	739	493
14	0.438	40	63.44	3166	2878	2590	2072	1727	1439	1151	863	576
14	0.469		67.77	3390	3082	2774	2219	1849	1541	1233	925	616
14	0.500	XS	72.09	3614	3286	2957	2366	1971	1643	1314	986	657
14	0.562		80.66	4062	3693	3324	2659	2216	1847	1477	1108	739
14	0.594		85.05	4294	3903	3513	2810	2342	1952	1561	1171	781
14	0.625		89.28	4518	4107	3696	2957	2464	2054	1643	1232	821
14	0.688		97.81	4973	4521	4069	3255	2713	2261	1808	1356	904
14	0.750	80	106.13	5421	4929	4436	3549	2957	2464	1971	1479	986
14	0.812		114.37	5870	5336	4802	3842	3202	2668	2134	1601	1067
16	0.219		36.91	1385	1259	1133	907	756	630	504	378	252
16	0.250		42.05	1581	1438	1294	1035	863	719	575	431	288
16	0.281		47.17	1777	1616	1454	1163	969	808	646	485	323
16	0.312		52.27	1973	1794	1615	1292	1076	897	718	538	359
16	0.344		57.52	2176	1978	1780	1424	1187	989	791	593	396
16	0.375	STD	62.58	2372	2156	1941	1553	1294	1078	863	647	431
16	0.438		72.80	2770	2519	2267	1813	1511	1259	1007	756	504
16	0.469		77.79	2966	2697	2427	1942	1618	1348	1079	809	539
16	0.500	XXS - 40	82.77	3163	2875	2588	2070	1725	1438	1150	863	575
16	0.562		92.66	3555	3232	2908	2327	1939	1616	1293	969	646
16	0.625		102.63	3953	3594	3234	2588	2156	1797	1438	1078	719
16	0.656		107.50	4149	3772	3395	2716	2263	1886	1509	1132	754
16	0.688		112.51	4352	3956	3560	2848	2374	1978	1582	1187	791
16	0.750		122.15	4744	4313	3881	3105	2588	2156	1725	1294	863
16	0.812		131.71	5136	4669	4202	3362	2801	2335	1868	1401	934
16	0.844	80	136.61	5338	4853	4368	3494	2912	2427	1941	1456	971
16	1.000		160.20	6325	5750	5175	4140	3450	2875	2300	1725	1150
18	0.250		47.39	1406	1278	1150	920	767	639	511	383	256
18	0.281		53.18	1580	1436	1293	1034	862	718	574	431	287
18	0.312		58.94	1754	1595	1435	1148	957	797	638	478	319
18	0.344		64.87	1934	1758	1582	1266	1055	879	703	527	352
18	0.375	STD	70.59	2108	1917	1725	1380	1150	958	767	575	383
18	0.406		76.29	2283	2075	1868	1494	1245	1038	830	623	415
18	0.438		82.15	2463	2239	2015	1612	1343	1119	895	672	448
18	0.469		87.81	2637	2397	2157	1726	1438	1199	959	719	479
18	0.500	XS	93.45	2811	2556	2300	1840	1533	1278	1022	767	511
18	0.562	40	104.66	3160	2872	2585	2068	1723	1436	1149	862	574
18	0.625		115.98	3514	3194	2875	2300	1917	1597	1278	958	639
18	0.688		127.20	3868	3516	3165	2532	2110	1758	1407	1055	703
18	0.750		138.17	4217	3833	3450	2760	2300	1917	1533	1150	767
18	0.812		149.05	4565	4150	3735	2988	2490	2075	1660	1245	830
18	0.938	80	170.92	5274	4794	4315	3452	2877	2397	1918	1438	959
18	1.000		181.56	5622	5111	4600	3680	3067	2556	2044	1533	1022
20	0.250		52.73	1265	1150	1035	828	690	575	460	345	230
20	0.278		58.55	1407	1279	1151	921	767	639	512	384	256
20	0.281		59.18	1422	1293	1163	931	776	646	517	388	259
20	0.312		65.60	1579	1435	1292	1033	861	718	574	431	287
20	0.334		70.15	1690	1536	1383	1106	922	768	615	461	307

EXHIBIT B
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YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
20	0.344		72.21	1741	1582	1424	1139	949	791	633	475	316
20	0.347		72.83	1756	1596	1437	1149	958	798	638	479	319
20	0.375	STD	78.60	1898	1725	1553	1242	1035	863	690	518	345
20	0.406		84.96	2054	1868	1681	1345	1121	934	747	560	374
20	0.417		87.21	2110	1918	1726	1381	1151	959	767	575	384
20	0.438		91.51	2216	2015	1813	1451	1209	1007	806	604	403
20	0.462		96.40	2338	2125	1913	1530	1275	1063	850	638	425
20	0.469		97.83	2373	2157	1942	1553	1294	1079	863	647	431
20	0.500	XS	104.13	2530	2300	2070	1656	1380	1150	920	690	460
20	0.562		116.67	2844	2585	2327	1861	1551	1293	1034	776	517
20	0.594	40	123.11	3006	2732	2459	1967	1639	1366	1093	820	546
20	0.625		129.33	3163	2875	2588	2070	1725	1438	1150	863	575
20	0.688		141.90	3481	3165	2848	2279	1899	1582	1266	949	633
20	0.750		154.19	3795	3450	3105	2484	2070	1725	1380	1035	690
20	0.812		166.40	4109	3735	3362	2689	2241	1868	1494	1121	747
20	1.000		202.92	5060	4600	4140	3312	2760	2300	1840	1380	920
22	0.250		58.07	1150	1045	941	753	627	523	418	314	209
22	0.281		65.18	1293	1175	1058	846	705	588	470	353	235
22	0.312		72.27	1435	1305	1174	939	783	652	522	391	261
22	0.344		79.56	1582	1439	1295	1036	863	719	575	432	288
22	0.375	STD	86.61	1725	1568	1411	1129	941	784	627	470	314
22	0.438		100.86	2015	1832	1648	1319	1099	916	733	549	366
22	0.500	XS	114.81	2300	2091	1882	1505	1255	1045	836	627	418
22	0.562		128.67	2585	2350	2115	1692	1410	1175	940	705	470
22	0.625		142.68	2875	2614	2352	1882	1568	1307	1045	784	523
22	0.688		156.59	3165	2877	2589	2072	1726	1439	1151	863	575
22	0.750		170.21	3450	3136	2823	2258	1882	1568	1255	941	627
22	0.812		183.74	3735	3396	3056	2445	2037	1698	1358	1019	679
24	0.250		63.41	1054	958	863	690	575	479	383	288	192
24	0.257		65.17	1084	985	887	709	591	493	394	296	197
24	0.278		70.43	1172	1066	959	767	639	533	426	320	213
24	0.281		71.18	1185	1077	969	776	646	539	431	323	215
24	0.300		75.93	1265	1150	1035	828	690	575	460	345	230
24	0.312		78.93	1316	1196	1076	861	718	598	478	359	239
24	0.334		84.42	1408	1280	1152	922	768	640	512	384	256
24	0.344		86.91	1451	1319	1187	949	791	659	527	396	264
24	0.370		93.37	1560	1418	1277	1021	851	709	567	426	284
24	0.375	STD	94.62	1581	1438	1294	1035	863	719	575	431	288
24	0.406		102.30	1712	1556	1401	1121	934	778	623	467	311
24	0.420		105.77	1771	1610	1449	1159	966	805	644	483	322
24	0.438		110.22	1847	1679	1511	1209	1007	840	672	504	336
24	0.469		117.86	1978	1798	1618	1294	1079	899	719	539	360
24	0.500	XS	125.49	2108	1917	1725	1380	1150	958	767	575	383
24	0.562		140.68	2370	2154	1939	1551	1293	1077	862	646	431
24	0.625		156.03	2635	2396	2156	1725	1438	1198	958	719	479
24	0.688	40	171.29	2901	2637	2374	1899	1582	1319	1055	791	527
24	0.750		186.23	3163	2875	2588	2070	1725	1438	1150	863	575
24	0.812		201.09	3424	3113	2801	2241	1868	1556	1245	934	623
24	1.000		245.64	4217	3833	3450	2760	2300	1917	1533	1150	767
26	0.250		68.75	973	885	796	637	531	442	354	265	177
26	0.278		76.37	1082	984	885	708	590	492	393	295	197
26	0.281		77.18	1094	994	895	716	597	497	398	298	199
26	0.301		82.61	1172	1065	959	767	639	533	426	320	213
26	0.312		85.60	1214	1104	994	795	662	552	442	331	221
26	0.334		91.55	1300	1182	1064	851	709	591	473	355	236
26	0.344		94.26	1339	1217	1096	876	730	609	487	365	243
26	0.361		98.85	1405	1277	1150	920	766	639	511	383	255

EXHIBIT B
(29 of 72)

YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
26	0.375	STD	102.63	1460	1327	1194	955	796	663	531	398	265
26	0.406		110.98	1580	1437	1293	1034	862	718	575	431	287
26	0.438		119.57	1705	1550	1395	1116	930	775	620	465	310
26	0.469		127.88	1825	1660	1494	1195	996	830	664	498	332
26	0.500	XS	136.17	1946	1769	1592	1274	1062	885	708	531	354
26	0.562		152.68	2187	1989	1790	1432	1193	994	795	597	398
26	0.625		169.38	2433	2212	1990	1592	1327	1106	885	663	442
26	0.688		185.99	2678	2434	2191	1753	1461	1217	974	730	487
26	0.750		202.25	2919	2654	2388	1911	1592	1327	1062	796	531
26	0.875		234.79	3406	3096	2787	2229	1858	1548	1238	929	619
26	1.000		267.00	3892	3538	3185	2548	2123	1769	1415	1062	708
28	0.250		74.09	904	821	739	591	493	411	329	246	164
28	0.281		83.19	1016	923	831	665	554	462	369	277	185
28	0.312		92.26	1128	1025	923	738	615	513	410	308	205
28	0.344		101.60	1243	1130	1017	814	678	565	452	339	226
28	0.375	STD	110.64	1355	1232	1109	887	739	616	493	370	246
28	0.406		119.65	1467	1334	1201	960	800	667	534	400	267
28	0.438		128.93	1583	1439	1295	1036	863	720	576	432	288
28	0.469		137.90	1695	1541	1387	1110	925	771	616	462	308
28	0.500	XS	146.85	1807	1643	1479	1183	986	821	657	493	329
28	0.562		164.68	2031	1847	1662	1330	1108	923	739	554	369
28	0.625		182.73	2259	2054	1848	1479	1232	1027	821	616	411
30	0.281		89.19	948	862	776	620	517	431	345	259	172
30	0.300		95.16	1012	920	828	662	552	460	368	276	184
30	0.312		98.92	1052	957	861	689	574	478	383	287	191
30	0.321		101.75	1083	984	886	709	591	492	394	295	197
30	0.323		102.37	1090	991	891	713	594	495	396	297	198
30	0.325		103.00	1096	997	897	718	598	498	399	299	199
30	0.344		108.95	1160	1055	949	760	633	527	422	316	211
30	0.347		109.89	1171	1064	958	766	638	532	426	319	213
30	0.360		113.96	1214	1104	994	795	662	552	442	331	221
30	0.375	STD	118.65	1265	1150	1035	828	690	575	460	345	230
30	0.385		121.77	1299	1181	1063	850	708	590	472	354	236
30	0.400		126.45	1349	1227	1104	883	736	613	491	368	245
30	0.406		128.32	1370	1245	1121	896	747	623	498	374	249
30	0.417		131.75	1407	1279	1151	921	767	639	512	384	256
30	0.420		132.68	1417	1288	1159	927	773	644	515	386	258
30	0.422		133.30	1424	1294	1165	932	776	647	518	388	259
30	0.438		138.28	1478	1343	1209	967	806	672	537	403	269
30	0.469		147.92	1582	1438	1294	1036	863	719	575	431	288
30	0.480		151.33	1619	1472	1325	1060	883	736	589	442	294
30	0.500	XS	157.53	1687	1533	1380	1104	920	767	613	460	307
30	0.504		158.77	1700	1546	1391	1113	927	773	618	464	309
30	0.525		165.26	1771	1610	1449	1159	966	805	644	483	322
30	0.530		166.81	1788	1625	1463	1170	975	813	650	488	325
30	0.562		176.69	1896	1723	1551	1241	1034	862	689	517	345
30	0.563		177.00	1899	1727	1554	1243	1036	863	691	518	345
30	0.625		196.08	2108	1917	1725	1380	1150	958	767	575	383
30	0.750		234.29	2530	2300	2070	1656	1380	1150	920	690	460
30	0.875		272.17	2952	2683	2415	1932	1610	1342	1073	805	537
30	1.000		309.72	3373	3067	2760	2208	1840	1533	1227	920	613
30.2	0.423		134.52	1417	1289	1160	928	773	644	515	387	258
32	0.250		84.77	791	719	647	518	431	359	288	216	144
32	0.281		95.19	889	808	727	582	485	404	323	242	162
32	0.312		105.59	987	897	807	646	538	449	359	269	179
32	0.344		116.30	1088	989	890	712	593	495	396	297	198

EXHIBIT B
(30 of 72)

YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
32	0.375	STD	126.66	1186	1078	970	776	647	539	431	323	216
32	0.406		136.99	1284	1167	1051	840	700	584	467	350	233
32	0.438		147.64	1385	1259	1133	907	756	630	504	378	252
32	0.469		157.93	1483	1348	1214	971	809	674	539	405	270
32	0.500	XS	168.21	1581	1438	1294	1035	863	719	575	431	288
32	0.562		188.69	1777	1616	1454	1163	969	808	646	485	323
32	0.625		209.43	1977	1797	1617	1294	1078	898	719	539	359
34	0.250		90.11	744	676	609	487	406	338	271	203	135
34	0.281		101.19	836	760	684	547	456	380	304	228	152
34	0.312		112.25	929	844	760	608	507	422	338	253	169
34	0.344		123.65	1024	931	838	670	558	465	372	279	186
34	0.375	STD	134.67	1116	1015	913	731	609	507	406	304	203
34	0.406		145.66	1208	1099	989	791	659	549	439	330	220
34	0.438		157.00	1304	1185	1067	853	711	593	474	356	237
34	0.469		167.95	1396	1269	1142	914	761	635	508	381	254
34	0.500	XS	178.89	1488	1353	1218	974	812	676	541	406	271
34	0.562		200.70	1673	1521	1369	1095	912	760	608	456	304
34	0.625		222.77	1860	1691	1522	1218	1015	846	676	507	338
36	0.312		118.92	877	797	718	574	478	399	319	239	159
36	0.344		131.00	967	879	791	633	527	440	352	264	176
36	0.356		135.52	1001	910	819	655	546	455	364	273	182
36	0.375	STD	142.68	1054	958	863	690	575	479	383	288	192
36	0.385		146.44	1082	984	886	708	590	492	394	295	197
36	0.388		147.57	1091	992	892	714	595	496	397	297	198
36	0.406		154.34	1141	1038	934	747	623	519	415	311	208
36	0.417		158.47	1172	1066	959	767	639	533	426	320	213
36	0.438		166.35	1231	1119	1007	806	672	560	448	336	224
36	0.450		170.85	1265	1150	1035	828	690	575	460	345	230
36	0.469		177.97	1318	1199	1079	863	719	599	479	360	240
36	0.500	XS	189.57	1406	1278	1150	920	767	639	511	383	256
36	0.504		191.06	1417	1288	1159	927	773	644	515	386	258
36	0.525		198.91	1476	1342	1208	966	805	671	537	403	268
36	0.540		204.50	1518	1380	1242	994	828	690	552	414	276
36	0.562		212.70	1580	1436	1293	1034	862	718	574	431	287
36	0.600		226.84	1687	1533	1380	1104	920	767	613	460	307
36	0.605		228.70	1701	1546	1392	1113	928	773	618	464	309
36	0.625		236.12	1757	1597	1438	1150	958	799	639	479	319
36	0.660		249.10	1855	1687	1518	1214	1012	843	675	506	337
36	0.688		259.46	1934	1758	1582	1266	1055	879	703	527	352
36	0.750		282.35	2108	1917	1725	1380	1150	958	767	575	383
36	0.875		328.24	2460	2236	2013	1610	1342	1118	894	671	447
36	1.000		373.79	2811	2556	2300	1840	1533	1278	1022	767	511
36.24	0.508		193.86	1419	1290	1161	929	774	645	516	387	258
38	0.312		125.58	831	755	680	544	453	378	302	227	151
38	0.344		138.34	916	833	750	600	500	416	333	250	167
38	0.375	STD	150.69	999	908	817	654	545	454	363	272	182
38	0.406		163.01	1081	983	885	708	590	491	393	295	197
38	0.438		175.71	1166	1060	954	764	636	530	424	318	212
38	0.469		187.99	1249	1135	1022	818	681	568	454	341	227
38	0.500	XS	200.25	1332	1211	1089	872	726	605	484	363	242
38	0.562		224.71	1497	1361	1225	980	816	680	544	408	272
38	0.625		249.47	1664	1513	1362	1089	908	757	605	454	303
40	0.344		145.69	870	791	712	570	475	396	316	237	158
40	0.375	STD	158.70	949	863	776	621	518	431	345	259	173
40	0.406		171.68	1027	934	840	672	560	467	374	280	187

EXHIBIT B
(31 of 72)

YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
40	0.438		185.06	1108	1007	907	725	604	504	403	302	201
40	0.469		198.00	1187	1079	971	777	647	539	431	324	216
40	0.500	XS	210.93	1265	1150	1035	828	690	575	460	345	230
40	0.562		236.71	1422	1293	1163	931	776	646	517	388	259
40	0.625		262.82	1581	1438	1294	1035	863	719	575	431	288
42	0.312		138.91	752	683	615	492	410	342	273	205	137
42	0.323		143.77	778	708	637	509	425	354	283	212	142
42	0.344		153.04	829	754	678	543	452	377	301	226	151
42	0.363		161.42	875	795	716	573	477	398	318	239	159
42	0.375	STD	166.71	904	821	739	591	493	411	329	246	164
42	0.406		180.35	978	889	800	640	534	445	356	267	178
42	0.417		185.19	1005	913	822	658	548	457	365	274	183
42	0.438		194.42	1055	959	863	691	576	480	384	288	192
42	0.450		199.69	1084	986	887	710	591	493	394	296	197
42	0.469		208.02	1130	1027	925	740	616	514	411	308	205
42	0.486		215.47	1171	1065	958	766	639	532	426	319	213
42	0.500	XS	221.61	1205	1095	986	789	657	548	438	329	219
42	0.562		248.71	1354	1231	1108	886	739	616	492	369	246
42	0.625		276.17	1506	1369	1232	986	821	685	548	411	274
42	0.688		303.55	1658	1507	1356	1085	904	754	603	452	301
42	0.750		330.41	1807	1643	1479	1183	986	821	657	493	329
42	0.812		357.18	1957	1779	1601	1281	1067	889	711	534	356
42	0.875		384.31	2108	1917	1725	1380	1150	958	767	575	383
42	1.000		437.87	2410	2190	1971	1577	1314	1095	876	657	438
44	0.312		145.57	718	652	587	470	391	326	261	196	130
44	0.334		155.76	768	698	629	503	419	349	279	210	140
44	0.344		160.39	791	719	647	518	432	360	288	216	144
44	0.370		172.41	851	774	696	557	464	387	309	232	155
44	0.375	STD	174.72	863	784	706	565	470	392	314	235	157
44	0.406		189.02	934	849	764	611	509	424	340	255	170
44	0.417		194.10	959	872	785	628	523	436	349	262	174
44	0.438		203.77	1007	916	824	659	549	458	366	275	183
44	0.469		218.04	1079	981	883	706	588	490	392	294	196
44	0.476		221.26	1095	995	896	717	597	498	398	299	199
44	0.500	XS	232.29	1150	1045	941	753	627	523	418	314	209
44	0.513		238.25	1180	1073	965	772	644	536	429	322	215
44	0.556		257.97	1279	1163	1046	837	698	581	465	349	233
44	0.562		260.72	1293	1175	1058	846	705	588	470	353	235
44	0.625		289.52	1438	1307	1176	941	784	653	523	392	261
44	0.688		318.25	1582	1439	1295	1036	863	719	575	432	288
44	0.750		346.43	1725	1568	1411	1129	941	784	627	470	314
44	0.812		374.53	1868	1698	1528	1222	1019	849	679	509	340
44	0.875		403.00	2013	1830	1647	1317	1098	915	732	549	366
44	1.000		459.23	2300	2091	1882	1505	1255	1045	836	627	418
46	0.312		152.24	686	624	562	449	374	312	250	187	125
46	0.334		162.89	735	668	601	481	401	334	267	200	134
46	0.344		167.73	757	688	619	495	413	344	275	206	138
46	0.370		180.31	814	740	666	533	444	370	296	222	148
46	0.375	STD	182.73	825	750	675	540	450	375	300	225	150
46	0.406		197.70	893	812	731	585	487	406	325	244	162
46	0.417		203.00	917	834	751	600	500	417	334	250	167
46	0.438		213.13	964	876	788	631	526	438	350	263	175
46	0.469		228.06	1032	938	844	675	563	469	375	281	188
46	0.476		231.43	1047	952	857	685	571	476	381	286	190
46	0.500	XS	242.97	1100	1000	900	720	600	500	400	300	200
46	0.513		249.21	1129	1026	923	739	616	513	410	308	205
46	0.556		269.85	1223	1112	1001	801	667	556	445	334	222

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 47 of 87

EXHIBIT B
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YIELD 46,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
46	0.562		272.72	1236	1124	1012	809	674	562	450	337	225
46	0.625		302.87	1375	1250	1125	900	750	625	500	375	250
46	0.688		332.94	1514	1376	1238	991	826	688	550	413	275
46	0.750		362.45	1650	1500	1350	1080	900	750	600	450	300
46	0.812		391.87	1786	1624	1462	1169	974	812	650	487	325
46	0.875		421.69	1925	1750	1575	1260	1050	875	700	525	350
46	1.000		480.59	2200	2000	1800	1440	1200	1000	800	600	400
48	0.312		158.90	658	598	538	431	359	299	239	179	120
48	0.334		170.03	704	640	576	461	384	320	256	192	128
48	0.344		175.08	725	659	593	475	396	330	264	198	132
48	0.370		188.21	780	709	638	511	426	355	284	213	142
48	0.375	STD	190.74	791	719	647	518	431	359	288	216	144
48	0.406		206.37	856	778	700	560	467	389	311	233	156
48	0.417		211.91	879	799	719	575	480	400	320	240	160
48	0.438		222.48	923	840	756	604	504	420	336	252	168
48	0.469		238.08	989	899	809	647	539	449	360	270	180
48	0.476		241.59	1004	912	821	657	547	456	365	274	182
48	0.500	XS	253.65	1054	958	863	690	575	479	383	288	192
48	0.513		260.17	1082	983	885	708	590	492	393	295	197
48	0.556		281.72	1172	1066	959	767	639	533	426	320	213
48	0.562		284.73	1185	1077	969	776	646	539	431	323	215
48	0.625		316.22	1318	1198	1078	863	719	599	479	359	240
48	0.688		347.64	1451	1319	1187	949	791	659	527	396	264
48	0.750		378.47	1581	1438	1294	1035	863	719	575	431	288
48	0.812		409.22	1712	1556	1401	1121	934	778	623	467	311
48	0.875		440.38	1845	1677	1509	1208	1006	839	671	503	335
48	1.000		501.95	2108	1917	1725	1380	1150	958	767	575	383

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 48 of 87

EXHIBIT B
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YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
2	0.154	STD - 40	3.65	7418	6744	6069	4855	4046	3372	2697	2023	1349
2	0.218	XS - 80	5.02	10501	9546	8591	6873	5728	4773	3818	2864	1909
2	0.250		5.67	12042	10947	9853	7882	6568	5474	4379	3284	2189
2	0.344	160	7.46	16570	15064	13557	10846	9038	7532	6025	4519	3013
2	0.436	XXS	9.03	21001	19092	17183	13746	11455	9546	7637	5728	3818
3	0.125		4.51	4086	3714	3343	2674	2229	1857	1486	1114	743
3	0.156		5.57	5099	4635	4172	3338	2781	2318	1854	1391	927
3	0.188		6.65	6145	5586	5028	4022	3352	2793	2235	1676	1117
3	0.216	STD - 40	7.58	7060	6418	5776	4621	3851	3209	2567	1925	1284
3	0.250		8.68	8171	7429	6686	5349	4457	3714	2971	2229	1486
3	0.281		9.66	9185	8350	7515	6012	5010	4175	3340	2505	1670
3	0.300	XS - 80	10.25	9806	8914	8023	6418	5349	4457	3566	2674	1783
3	0.438	160	14.32	14316	13015	11713	9371	7809	6507	5206	3904	2603
3	0.600	XXS	18.58	19611	17829	16046	12837	10697	8914	7131	5349	3566
4	0.125		5.84	3178	2889	2600	2080	1733	1444	1156	867	578
4	0.141		6.56	3585	3259	2933	2346	1955	1629	1303	978	652
4	0.156		7.24	3966	3605	3245	2596	2163	1803	1442	1082	721
4	0.172		7.95	4373	3975	3578	2862	2385	1988	1590	1193	795
4	0.188		8.66	4779	4345	3910	3128	2607	2172	1738	1303	869
4	0.203		9.32	5161	4692	4222	3378	2815	2346	1877	1407	938
4	0.219		10.01	5567	5061	4555	3644	3037	2531	2025	1518	1012
4	0.237	STD - 40	10.79	6025	5477	4930	3944	3286	2739	2191	1643	1095
4	0.250		11.35	6356	5778	5200	4160	3467	2889	2311	1733	1156
4	0.281		12.66	7144	6494	5845	4676	3897	3247	2598	1948	1299
4	0.312		13.95	7932	7211	6490	5192	4326	3605	2884	2163	1442
4	0.337	XS - 80	14.98	8567	7788	7010	5608	4673	3894	3115	2337	1558
4	0.438	120	19.00	11135	10123	9110	7288	6074	5061	4049	3037	2025
4	0.500		21.36	12711	11556	10400	8320	6933	5778	4622	3467	2311
4	0.531	160	22.51	13499	12272	11045	8836	7363	6136	4909	3682	2454
4	0.674	XXS	27.54	17135	15577	14019	11215	9346	7788	6231	4673	3115
5	0.156		9.01	3208	2916	2625	2100	1750	1458	1167	875	583
5	0.188		10.79	3866	3515	3163	2531	2109	1757	1406	1054	703
5	0.219		12.50	4504	4094	3685	2948	2457	2047	1638	1228	819
5	0.258	STD - 40	14.62	5306	4823	4341	3473	2894	2412	1929	1447	965
5	0.281		15.85	5779	5253	4728	3782	3152	2627	2101	1576	1051
5	0.312		17.50	6416	5833	5250	4200	3500	2916	2333	1750	1167
5	0.344		19.17	7074	6431	5788	4630	3859	3216	2572	1929	1286
5	0.375	XS - 80	20.78	7712	7011	6310	5048	4206	3505	2804	2103	1402
5	0.500	120	27.04	10282	9347	8413	6730	5608	4674	3739	2804	1869
5	0.625	160	32.96	12853	11684	10516	8413	7011	5842	4674	3505	2337
5	0.750	XXS	38.55	15423	14021	12619	10095	8413	7011	5608	4206	2804
6	0.156		10.78	2694	2449	2204	1763	1469	1224	980	735	490
6	0.172		11.85	2970	2700	2430	1944	1620	1350	1080	810	540
6	0.188		12.92	3246	2951	2656	2125	1771	1476	1180	885	590
6	0.203		13.92	3505	3187	2868	2294	1912	1593	1275	956	637
6	0.219		14.98	3782	3438	3094	2475	2063	1719	1375	1031	688
6	0.250		17.02	4317	3925	3532	2826	2355	1962	1570	1177	785
6	0.277		18.78	4783	4348	3914	3131	2609	2174	1739	1305	870
6	0.280	STD - 40	18.97	4835	4395	3956	3165	2637	2198	1758	1319	879
6	0.312		21.04	5388	4898	4408	3526	2939	2449	1959	1469	980
6	0.344		23.08	5940	5400	4860	3888	3240	2700	2160	1620	1080
6	0.375		25.03	6475	5887	5298	4238	3532	2943	2355	1766	1177
6	0.432	XS - 80	28.57	7460	6782	6103	4883	4069	3391	2713	2034	1356
6	0.500		32.71	8634	7849	7064	5651	4709	3925	3140	2355	1570
6	0.562	120	36.39	9705	8822	7940	6352	5293	4411	3529	2647	1764
6	0.625		40.05	10792	9811	8830	7064	5887	4906	3925	2943	1962

EXHIBIT B
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YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
6	0.719	160	45.35	12416	11287	10158	8127	6772	5643	4515	3386	2257
6	0.864	XXS	53.16	14919	13563	12207	9765	8138	6782	5425	4069	2713
8	0.172		15.53	2281	2074	1867	1493	1244	1037	830	622	415
8	0.188		16.94	2494	2267	2040	1632	1360	1133	907	680	453
8	0.203		18.26	2693	2448	2203	1762	1469	1224	979	734	490
8	0.219		19.66	2905	2641	2377	1901	1584	1320	1056	792	528
8	0.250		22.36	3316	3014	2713	2170	1809	1507	1206	904	603
8	0.277		24.70	3674	3340	3006	2405	2004	1670	1336	1002	668
8	0.312		27.70	4138	3762	3386	2709	2257	1881	1505	1129	752
8	0.322	STD - 40	28.55	4271	3883	3494	2796	2330	1941	1553	1165	777
8	0.344		30.42	4563	4148	3733	2987	2489	2074	1659	1244	830
8	0.375		33.04	4974	4522	4070	3256	2713	2261	1809	1357	904
8	0.406		35.64	5385	4896	4406	3525	2937	2448	1958	1469	979
8	0.438		38.30	5810	5281	4753	3803	3169	2641	2113	1584	1056
8	0.500	XS - 80	43.39	6632	6029	5426	4341	3617	3014	2412	1809	1206
8	0.562		48.39	7454	6777	6099	4879	4066	3388	2711	2033	1355
8	0.594		50.95	7879	7162	6446	5157	4297	3581	2865	2149	1432
8	0.625		53.40	8290	7536	6783	5426	4522	3768	3014	2261	1507
8	0.719	120	60.71	9537	8670	7803	6242	5202	4335	3468	2601	1734
8	0.812		67.75	10770	9791	8812	7050	5875	4896	3916	2937	1958
8	0.875	XXS	72.42	11606	10551	9496	7597	6330	5275	4220	3165	2110
8	0.906	160	74.69	12017	10925	9832	7866	6555	5462	4370	3277	2185
10	0.188		21.21	2001	1819	1637	1310	1091	909	728	546	364
10	0.203		22.87	2160	1964	1768	1414	1178	982	786	589	393
10	0.219		24.63	2331	2119	1907	1525	1271	1059	847	636	424
10	0.250		28.03	2660	2419	2177	1741	1451	1209	967	726	484
10	0.279		31.20	2969	2699	2429	1943	1619	1350	1080	810	540
10	0.307		34.24	3267	2970	2673	2138	1782	1485	1188	891	594
10	0.344		38.23	3661	3328	2995	2396	1997	1664	1331	998	666
10	0.365	STD - 40	40.48	3884	3531	3178	2542	2119	1766	1412	1059	706
10	0.438		48.24	4661	4237	3814	3051	2542	2119	1695	1271	847
10	0.500	XS	54.73	5321	4837	4353	3483	2902	2419	1935	1451	967
10	0.562		61.15	5981	5437	4893	3915	3262	2719	2175	1631	1087
10	0.594	80	64.43	6321	5747	5172	4138	3448	2873	2299	1724	1149
10	0.625		67.58	6651	6047	5442	4353	3628	3023	2419	1814	1209
10	0.719		77.03	7651	6956	6260	5008	4174	3478	2782	2087	1391
10	0.750		80.10	7981	7256	6530	5224	4353	3628	2902	2177	1451
10	0.812		86.18	8641	7856	7070	5656	4713	3928	3142	2357	1571
10	0.844	120	89.29	8982	8165	7349	5879	4899	4083	3266	2450	1633
10	0.875		92.28	9312	8465	7619	6095	5079	4233	3386	2540	1693
10	1.000	XXS	104.13	10642	9674	8707	6966	5805	4837	3870	2902	1935
12	0.203		27.20	1821	1656	1490	1192	994	828	662	497	331
12	0.219		29.31	1965	1786	1608	1286	1072	893	715	536	357
12	0.250		33.37	2243	2039	1835	1468	1224	1020	816	612	408
12	0.281		37.42	2521	2292	2063	1650	1375	1146	917	688	458
12	0.312		41.44	2799	2545	2290	1832	1527	1272	1018	763	509
12	0.330		43.77	2961	2692	2423	1938	1615	1346	1077	808	538
12	0.344		45.58	3087	2806	2525	2020	1684	1403	1122	842	561
12	0.375	STD	49.56	3365	3059	2753	2202	1835	1529	1224	918	612
12	0.406	40	53.52	3643	3312	2981	2384	1987	1656	1325	994	662
12	0.438		57.59	3930	3573	3215	2572	2144	1786	1429	1072	715
12	0.500	XS	65.41	4486	4078	3671	2936	2447	2039	1631	1224	816
12	0.562		73.15	5043	4584	4126	3301	2750	2292	1834	1375	917
12	0.625		80.93	5608	5098	4588	3671	3059	2549	2039	1529	1020
12	0.688	80	88.63	6173	5612	5051	4041	3367	2806	2245	1684	1122
12	0.750		96.12	6729	6118	5506	4405	3671	3059	2447	1835	1224
12	0.844		107.32	7573	6884	6196	4957	4131	3442	2754	2065	1377

EXHIBIT B
(35 of 72)

YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
12	0.875		110.97	7851	7137	6424	5139	4282	3569	2855	2141	1427
12	1.000	XXS - 120	125.49	8973	8157	7341	5873	4894	4078	3263	2447	1631
14	0.210		30.93	1716	1560	1404	1123	936	780	624	468	312
14	0.219		32.23	1790	1627	1464	1171	976	813	651	488	325
14	0.250		36.71	2043	1857	1671	1337	1114	929	743	557	371
14	0.281		41.17	2296	2087	1879	1503	1252	1044	835	626	417
14	0.312		45.61	2549	2318	2086	1669	1391	1159	927	695	464
14	0.344		50.17	2811	2555	2300	1840	1533	1278	1022	767	511
14	0.375	STD	54.57	3064	2786	2507	2006	1671	1393	1114	836	557
14	0.438	40	63.44	3579	3254	2928	2343	1952	1627	1301	976	651
14	0.469		67.77	3832	3484	3136	2508	2090	1742	1394	1045	697
14	0.500	XS	72.09	4086	3714	3343	2674	2229	1857	1486	1114	743
14	0.562		80.66	4592	4175	3757	3006	2505	2087	1670	1252	835
14	0.594		85.05	4854	4413	3971	3177	2648	2206	1765	1324	883
14	0.625		89.28	5107	4643	4179	3343	2786	2321	1857	1393	929
14	0.688		97.81	5622	5111	4600	3680	3067	2555	2044	1533	1022
14	0.750	80	106.13	6129	5571	5014	4011	3343	2786	2229	1671	1114
14	0.812		114.37	6635	6032	5429	4343	3619	3016	2413	1810	1206
16	0.219		36.91	1566	1424	1281	1025	854	712	569	427	285
16	0.250		42.05	1788	1625	1463	1170	975	813	650	488	325
16	0.281		47.17	2009	1827	1644	1315	1096	913	731	548	365
16	0.312		52.27	2231	2028	1825	1460	1217	1014	811	608	406
16	0.344		57.52	2460	2236	2012	1610	1342	1118	894	671	447
16	0.375	STD	62.58	2681	2438	2194	1755	1463	1219	975	731	488
16	0.438		72.80	3132	2847	2562	2050	1708	1424	1139	854	569
16	0.469		77.79	3353	3049	2744	2195	1829	1524	1219	915	610
16	0.500	XXS - 40	82.77	3575	3250	2925	2340	1950	1625	1300	975	650
16	0.562		92.66	4018	3653	3288	2630	2192	1827	1461	1096	731
16	0.625		102.63	4469	4063	3656	2925	2438	2031	1625	1219	813
16	0.656		107.50	4690	4264	3838	3070	2558	2132	1706	1279	853
16	0.688		112.51	4919	4472	4025	3220	2683	2236	1789	1342	894
16	0.750		122.15	5363	4875	4388	3510	2925	2438	1950	1463	975
16	0.812		131.71	5806	5278	4750	3800	3167	2639	2111	1583	1056
16	0.844	80	136.61	6035	5486	4937	3950	3292	2743	2194	1646	1097
16	1.000		160.20	7150	6500	5850	4680	3900	3250	2600	1950	1300
18	0.250		47.39	1589	1444	1300	1040	867	722	578	433	289
18	0.281		53.18	1786	1624	1461	1169	974	812	649	487	325
18	0.312		58.94	1983	1803	1622	1298	1082	901	721	541	361
18	0.344		64.87	2186	1988	1789	1431	1193	994	795	596	398
18	0.375	STD	70.59	2383	2167	1950	1560	1300	1083	867	650	433
18	0.406		76.29	2580	2346	2111	1689	1407	1173	938	704	469
18	0.438		82.15	2784	2531	2278	1822	1518	1265	1012	759	506
18	0.469		87.81	2981	2710	2439	1951	1626	1355	1084	813	542
18	0.500	XS	93.45	3178	2889	2600	2080	1733	1444	1156	867	578
18	0.562	40	104.66	3572	3247	2922	2338	1948	1624	1299	974	649
18	0.625		115.98	3972	3611	3250	2600	2167	1806	1444	1083	722
18	0.688		127.20	4373	3975	3578	2862	2385	1988	1590	1193	795
18	0.750		138.17	4767	4333	3900	3120	2600	2167	1733	1300	867
18	0.812		149.05	5161	4692	4222	3378	2815	2346	1877	1407	938
18	0.938	80	170.92	5962	5420	4878	3902	3252	2710	2168	1626	1084
18	1.000		181.56	6356	5778	5200	4160	3467	2889	2311	1733	1156
20	0.250		52.73	1430	1300	1170	936	780	650	520	390	260
20	0.278		58.55	1590	1446	1301	1041	867	723	578	434	289
20	0.281		59.18	1607	1461	1315	1052	877	731	584	438	292
20	0.312		65.60	1785	1622	1460	1168	973	811	649	487	324
20	0.334		70.15	1910	1737	1563	1250	1042	868	695	521	347

EXHIBIT B
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YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
20	0.344		72.21	1968	1789	1610	1288	1073	894	716	537	358
20	0.347		72.83	1985	1804	1624	1299	1083	902	722	541	361
20	0.375	STD	78.60	2145	1950	1755	1404	1170	975	780	585	390
20	0.406		84.96	2322	2111	1900	1520	1267	1056	844	633	422
20	0.417		87.21	2385	2168	1952	1561	1301	1084	867	651	434
20	0.438		91.51	2505	2278	2050	1640	1367	1139	911	683	456
20	0.462		96.40	2643	2402	2162	1730	1441	1201	961	721	480
20	0.469		97.83	2683	2439	2195	1756	1463	1219	976	732	488
20	0.500	XS	104.13	2860	2600	2340	1872	1560	1300	1040	780	520
20	0.562		116.67	3215	2922	2630	2104	1753	1461	1169	877	584
20	0.594	40	123.11	3398	3089	2780	2224	1853	1544	1236	927	618
20	0.625		129.33	3575	3250	2925	2340	1950	1625	1300	975	650
20	0.688		141.90	3935	3578	3220	2576	2147	1789	1431	1073	716
20	0.750		154.19	4290	3900	3510	2808	2340	1950	1560	1170	780
20	0.812		166.40	4645	4222	3800	3040	2533	2111	1689	1267	844
20	1.000		202.92	5720	5200	4680	3744	3120	2600	2080	1560	1040
22	0.250		58.07	1300	1182	1064	851	709	591	473	355	236
22	0.281		65.18	1461	1328	1196	956	797	664	531	399	266
22	0.312		72.27	1622	1475	1327	1062	885	737	590	442	295
22	0.344		79.56	1789	1626	1464	1171	976	813	650	488	325
22	0.375	STD	86.61	1950	1773	1595	1276	1064	886	709	532	355
22	0.438		100.86	2278	2071	1863	1491	1242	1035	828	621	414
22	0.500	XS	114.81	2600	2364	2127	1702	1418	1182	945	709	473
22	0.562		128.67	2922	2657	2391	1913	1594	1328	1063	797	531
22	0.625		142.68	3250	2955	2659	2127	1773	1477	1182	886	591
22	0.688		156.59	3578	3252	2927	2342	1951	1626	1301	976	650
22	0.750		170.21	3900	3545	3191	2553	2127	1773	1418	1064	709
22	0.812		183.74	4222	3839	3455	2764	2303	1919	1535	1152	768
24	0.250		63.41	1192	1083	975	780	650	542	433	325	217
24	0.257		65.17	1225	1114	1002	802	668	557	445	334	223
24	0.278		70.43	1325	1205	1084	867	723	602	482	361	241
24	0.281		71.18	1339	1218	1096	877	731	609	487	365	244
24	0.300		75.93	1430	1300	1170	936	780	650	520	390	260
24	0.312		78.93	1487	1352	1217	973	811	676	541	406	270
24	0.334		84.42	1592	1447	1303	1042	868	724	579	434	289
24	0.344		86.91	1640	1491	1342	1073	894	745	596	447	298
24	0.370		93.37	1764	1603	1443	1154	962	802	641	481	321
24	0.375	STD	94.62	1788	1625	1463	1170	975	813	650	488	325
24	0.406		102.30	1935	1759	1583	1267	1056	880	704	528	352
24	0.420		105.77	2002	1820	1638	1310	1092	910	728	546	364
24	0.438		110.22	2088	1898	1708	1367	1139	949	759	569	380
24	0.469		117.86	2236	2032	1829	1463	1219	1016	813	610	406
24	0.500	XS	125.49	2383	2167	1950	1560	1300	1083	867	650	433
24	0.562		140.68	2679	2435	2192	1753	1461	1218	974	731	487
24	0.625		156.03	2979	2708	2438	1950	1625	1354	1083	813	542
24	0.688	40	171.29	3279	2981	2683	2147	1789	1491	1193	894	596
24	0.750		186.23	3575	3250	2925	2340	1950	1625	1300	975	650
24	0.812		201.09	3871	3519	3167	2533	2111	1759	1407	1056	704
24	1.000		245.64	4767	4333	3900	3120	2600	2167	1733	1300	867
26	0.250		68.75	1100	1000	900	720	600	500	400	300	200
26	0.278		76.37	1223	1112	1001	801	667	556	445	334	222
26	0.281		77.18	1236	1124	1012	809	674	562	450	337	225
26	0.301		82.61	1324	1204	1084	867	722	602	482	361	241
26	0.312		85.60	1373	1248	1123	899	749	624	499	374	250
26	0.334		91.55	1470	1336	1202	962	802	668	534	401	267
26	0.344		94.26	1514	1376	1238	991	826	688	550	413	275
26	0.361		98.85	1588	1444	1300	1040	866	722	578	433	289

EXHIBIT B
(37 of 72)

YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
26	0.375	STD	102.63	1650	1500	1350	1080	900	750	600	450	300
26	0.406		110.98	1786	1624	1462	1169	974	812	650	487	325
26	0.438		119.57	1927	1752	1577	1261	1051	876	701	526	350
26	0.469		127.88	2064	1876	1688	1351	1126	938	750	563	375
26	0.500	XS	136.17	2200	2000	1800	1440	1200	1000	800	600	400
26	0.562		152.68	2473	2248	2023	1619	1349	1124	899	674	450
26	0.625		169.38	2750	2500	2250	1800	1500	1250	1000	750	500
26	0.688		185.99	3027	2752	2477	1981	1651	1376	1101	826	550
26	0.750		202.25	3300	3000	2700	2160	1800	1500	1200	900	600
26	0.875		234.79	3850	3500	3150	2520	2100	1750	1400	1050	700
26	1.000		267.00	4400	4000	3600	2880	2400	2000	1600	1200	800
28	0.250		74.09	1021	929	836	669	557	464	371	279	186
28	0.281		83.19	1148	1044	939	751	626	522	417	313	209
28	0.312		92.26	1275	1159	1043	834	695	579	464	348	232
28	0.344		101.60	1405	1278	1150	920	767	639	511	383	256
28	0.375	STD	110.64	1532	1393	1254	1003	836	696	557	418	279
28	0.406		119.65	1659	1508	1357	1086	905	754	603	452	302
28	0.438		128.93	1790	1627	1464	1171	976	813	651	488	325
28	0.469		137.90	1916	1742	1568	1254	1045	871	697	523	348
28	0.500	XS	146.85	2043	1857	1671	1337	1114	929	743	557	371
28	0.562		164.68	2296	2087	1879	1503	1252	1044	835	626	417
28	0.625		182.73	2554	2321	2089	1671	1393	1161	929	696	464
30	0.281		89.19	1072	974	877	701	584	487	390	292	195
30	0.300		95.16	1144	1040	936	749	624	520	416	312	208
30	0.312		98.92	1190	1082	973	779	649	541	433	324	216
30	0.321		101.75	1224	1113	1002	801	668	556	445	334	223
30	0.323		102.37	1232	1120	1008	806	672	560	448	336	224
30	0.325		103.00	1239	1127	1014	811	676	563	451	338	225
30	0.344		108.95	1312	1193	1073	859	716	596	477	358	239
30	0.347		109.89	1323	1203	1083	866	722	601	481	361	241
30	0.360		113.96	1373	1248	1123	899	749	624	499	374	250
30	0.375	STD	118.65	1430	1300	1170	936	780	650	520	390	260
30	0.385		121.77	1468	1335	1201	961	801	667	534	400	267
30	0.400		126.45	1525	1387	1248	998	832	693	555	416	277
30	0.406		128.32	1548	1407	1267	1013	844	704	563	422	281
30	0.417		131.75	1590	1446	1301	1041	867	723	578	434	289
30	0.420		132.68	1602	1456	1310	1048	874	728	582	437	291
30	0.422		133.30	1609	1463	1317	1053	878	731	585	439	293
30	0.438		138.28	1670	1518	1367	1093	911	759	607	456	304
30	0.469		147.92	1788	1626	1463	1171	976	813	650	488	325
30	0.480		151.33	1830	1664	1498	1198	998	832	666	499	333
30	0.500	XS	157.53	1907	1733	1560	1248	1040	867	693	520	347
30	0.504		158.77	1922	1747	1572	1258	1048	874	699	524	349
30	0.525		165.26	2002	1820	1638	1310	1092	910	728	546	364
30	0.530		166.81	2021	1837	1654	1323	1102	919	735	551	367
30	0.562		176.69	2143	1948	1753	1403	1169	974	779	584	390
30	0.563		177.00	2147	1952	1757	1405	1171	976	781	586	390
30	0.625		196.08	2383	2167	1950	1560	1300	1083	867	650	433
30	0.750		234.29	2860	2600	2340	1872	1560	1300	1040	780	520
30	0.875		272.17	3337	3033	2730	2184	1820	1517	1213	910	607
30	1.000		309.72	3813	3467	3120	2496	2080	1733	1387	1040	693
30.2	0.423		134.52	1602	1457	1311	1049	874	728	583	437	291
32	0.250		84.77	894	813	731	585	488	406	325	244	163
32	0.281		95.19	1005	913	822	658	548	457	365	274	183
32	0.312		105.59	1115	1014	913	730	608	507	406	304	203
32	0.344		116.30	1230	1118	1006	805	671	559	447	335	224

EXHIBIT B
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YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
32	0.375	STD	126.66	1341	1219	1097	878	731	609	488	366	244
32	0.406		136.99	1451	1320	1188	950	792	660	528	396	264
32	0.438		147.64	1566	1424	1281	1025	854	712	569	427	285
32	0.469		157.93	1677	1524	1372	1097	915	762	610	457	305
32	0.500	XS	168.21	1788	1625	1463	1170	975	813	650	488	325
32	0.562		188.69	2009	1827	1644	1315	1096	913	731	548	365
32	0.625		209.43	2234	2031	1828	1463	1219	1016	813	609	406
34	0.250		90.11	841	765	688	551	459	382	306	229	153
34	0.281		101.19	945	860	774	619	516	430	344	258	172
34	0.312		112.25	1050	954	859	687	573	477	382	286	191
34	0.344		123.65	1157	1052	947	758	631	526	421	316	210
34	0.375	STD	134.67	1262	1147	1032	826	688	574	459	344	229
34	0.406		145.66	1366	1242	1118	894	745	621	497	373	248
34	0.438		157.00	1474	1340	1206	965	804	670	536	402	268
34	0.469		167.95	1578	1435	1291	1033	861	717	574	430	287
34	0.500	XS	178.89	1682	1529	1376	1101	918	765	612	459	306
34	0.562		200.70	1891	1719	1547	1238	1031	860	688	516	344
34	0.625		222.77	2103	1912	1721	1376	1147	956	765	574	382
36	0.312		118.92	991	901	811	649	541	451	361	270	180
36	0.344		131.00	1093	994	894	716	596	497	398	298	199
36	0.356		135.52	1131	1028	926	740	617	514	411	309	206
36	0.375	STD	142.68	1192	1083	975	780	650	542	433	325	217
36	0.385		146.44	1223	1112	1001	801	667	556	445	334	222
36	0.388		147.57	1233	1121	1009	807	673	560	448	336	224
36	0.406		154.34	1290	1173	1056	844	704	586	469	352	235
36	0.417		158.47	1325	1205	1084	867	723	602	482	361	241
36	0.438		166.35	1392	1265	1139	911	759	633	506	380	253
36	0.450		170.85	1430	1300	1170	936	780	650	520	390	260
36	0.469		177.97	1490	1355	1219	976	813	677	542	406	271
36	0.500	XS	189.57	1589	1444	1300	1040	867	722	578	433	289
36	0.504		191.06	1602	1456	1310	1048	874	728	582	437	291
36	0.525		198.91	1668	1517	1365	1092	910	758	607	455	303
36	0.540		204.50	1716	1560	1404	1123	936	780	624	468	312
36	0.562		212.70	1786	1624	1461	1169	974	812	649	487	325
36	0.600		226.84	1907	1733	1560	1248	1040	867	693	520	347
36	0.605		228.70	1923	1748	1573	1258	1049	874	699	524	350
36	0.625		236.12	1986	1806	1625	1300	1083	903	722	542	361
36	0.660		249.10	2097	1907	1716	1373	1144	953	763	572	381
36	0.688		259.46	2186	1988	1789	1431	1193	994	795	596	398
36	0.750		282.35	2383	2167	1950	1560	1300	1083	867	650	433
36	0.875		328.24	2781	2528	2275	1820	1517	1264	1011	758	506
36	1.000		373.79	3178	2889	2600	2080	1733	1444	1156	867	578
36.24	0.508		193.86	1604	1458	1312	1050	875	729	583	437	292
38	0.312		125.58	939	854	769	615	512	427	342	256	171
38	0.344		138.34	1036	941	847	678	565	471	377	282	188
38	0.375	STD	150.69	1129	1026	924	739	616	513	411	308	205
38	0.406		163.01	1222	1111	1000	800	667	556	444	333	222
38	0.438		175.71	1319	1199	1079	863	719	599	479	360	240
38	0.469		187.99	1412	1284	1155	924	770	642	513	385	257
38	0.500	XS	200.25	1505	1368	1232	985	821	684	547	411	274
38	0.562		224.71	1692	1538	1384	1107	923	769	615	461	308
38	0.625		249.47	1882	1711	1539	1232	1026	855	684	513	342
40	0.344		145.69	984	894	805	644	537	447	358	268	179
40	0.375	STD	158.70	1073	975	878	702	585	488	390	293	195
40	0.406		171.68	1161	1056	950	760	633	528	422	317	211

EXHIBIT B
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YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
40	0.438		185.06	1253	1139	1025	820	683	569	456	342	228
40	0.469		198.00	1341	1219	1097	878	732	610	488	366	244
40	0.500	XS	210.93	1430	1300	1170	936	780	650	520	390	260
40	0.562		236.71	1607	1461	1315	1052	877	731	584	438	292
40	0.625		262.82	1788	1625	1463	1170	975	813	650	488	325
42	0.312		138.91	850	773	695	556	464	386	309	232	155
42	0.323		143.77	880	800	720	576	480	400	320	240	160
42	0.344		153.04	937	852	767	613	511	426	341	256	170
42	0.363		161.42	989	899	809	647	539	449	360	270	180
42	0.375	STD	166.71	1021	929	836	669	557	464	371	279	186
42	0.406		180.35	1106	1005	905	724	603	503	402	302	201
42	0.417		185.19	1136	1033	929	743	620	516	413	310	207
42	0.438		194.42	1193	1085	976	781	651	542	434	325	217
42	0.450		199.69	1226	1114	1003	802	669	557	446	334	223
42	0.469		208.02	1277	1161	1045	836	697	581	465	348	232
42	0.486		215.47	1324	1203	1083	866	722	602	481	361	241
42	0.500	XS	221.61	1362	1238	1114	891	743	619	495	371	248
42	0.562		248.71	1531	1392	1252	1002	835	696	557	417	278
42	0.625		276.17	1702	1548	1393	1114	929	774	619	464	310
42	0.688		303.55	1874	1704	1533	1227	1022	852	681	511	341
42	0.750		330.41	2043	1857	1671	1337	1114	929	743	557	371
42	0.812		357.18	2212	2011	1810	1448	1206	1005	804	603	402
42	0.875		384.31	2383	2167	1950	1560	1300	1083	867	650	433
42	1.000		437.87	2724	2476	2229	1783	1486	1238	990	743	495
44	0.312		145.57	811	737	664	531	442	369	295	221	147
44	0.334		155.76	868	789	711	568	474	395	316	237	158
44	0.344		160.39	894	813	732	585	488	407	325	244	163
44	0.370		172.41	962	875	787	630	525	437	350	262	175
44	0.375	STD	174.72	975	886	798	638	532	443	355	266	177
44	0.406		189.02	1056	960	864	691	576	480	384	288	192
44	0.417		194.10	1084	986	887	710	591	493	394	296	197
44	0.438		203.77	1139	1035	932	745	621	518	414	311	207
44	0.469		218.04	1219	1109	998	798	665	554	443	333	222
44	0.476		221.26	1238	1125	1013	810	675	563	450	338	225
44	0.500	XS	232.29	1300	1182	1064	851	709	591	473	355	236
44	0.513		238.25	1334	1213	1091	873	728	606	485	364	243
44	0.556		257.97	1446	1314	1183	946	789	657	526	394	263
44	0.562		260.72	1461	1328	1196	956	797	664	531	399	266
44	0.625		289.52	1625	1477	1330	1064	886	739	591	443	295
44	0.688		318.25	1789	1626	1464	1171	976	813	650	488	325
44	0.750		346.43	1950	1773	1595	1276	1064	886	709	532	355
44	0.812		374.53	2111	1919	1727	1382	1152	960	768	576	384
44	0.875		403.00	2275	2068	1861	1489	1241	1034	827	620	414
44	1.000		459.23	2600	2364	2127	1702	1418	1182	945	709	473
46	0.312		152.24	776	705	635	508	423	353	282	212	141
46	0.334		162.89	831	755	680	544	453	378	302	227	151
46	0.344		167.73	856	778	700	560	467	389	311	233	156
46	0.370		180.31	920	837	753	602	502	418	335	251	167
46	0.375	STD	182.73	933	848	763	610	509	424	339	254	170
46	0.406		197.70	1010	918	826	661	551	459	367	275	184
46	0.417		203.00	1037	943	849	679	566	471	377	283	189
46	0.438		213.13	1089	990	891	713	594	495	396	297	198
46	0.469		228.06	1166	1060	954	763	636	530	424	318	212
46	0.476		231.43	1184	1076	969	775	646	538	430	323	215
46	0.500	XS	242.97	1243	1130	1017	814	678	565	452	339	226
46	0.513		249.21	1276	1160	1044	835	696	580	464	348	232
46	0.556		269.85	1383	1257	1131	905	754	629	503	377	251

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 55 of 87

EXHIBIT B
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YIELD 52,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
46	0.562		272.72	1398	1271	1144	915	762	635	508	381	254
46	0.625		302.87	1554	1413	1272	1017	848	707	565	424	283
46	0.688		332.94	1711	1555	1400	1120	933	778	622	467	311
46	0.750		362.45	1865	1696	1526	1221	1017	848	678	509	339
46	0.812		391.87	2019	1836	1652	1322	1101	918	734	551	367
46	0.875		421.69	2176	1978	1780	1424	1187	989	791	593	396
46	1.000		480.59	2487	2261	2035	1628	1357	1130	904	678	452
48	0.312		158.90	744	676	608	487	406	338	270	203	135
48	0.334		170.03	796	724	651	521	434	362	289	217	145
48	0.344		175.08	820	745	671	537	447	373	298	224	149
48	0.370		188.21	882	802	722	577	481	401	321	241	160
48	0.375	STD	190.74	894	813	731	585	488	406	325	244	163
48	0.406		206.37	968	880	792	633	528	440	352	264	176
48	0.417		211.91	994	904	813	651	542	452	361	271	181
48	0.438		222.48	1044	949	854	683	569	475	380	285	190
48	0.469		238.08	1118	1016	915	732	610	508	406	305	203
48	0.476		241.59	1134	1031	928	743	619	516	413	309	206
48	0.500	XS	253.65	1192	1083	975	780	650	542	433	325	217
48	0.513		260.17	1223	1112	1000	800	667	556	445	333	222
48	0.556		281.72	1325	1205	1084	867	723	602	482	361	241
48	0.562		284.73	1339	1218	1096	877	731	609	487	365	244
48	0.625		316.22	1490	1354	1219	975	813	677	542	406	271
48	0.688		347.64	1640	1491	1342	1073	894	745	596	447	298
48	0.750		378.47	1788	1625	1463	1170	975	813	650	488	325
48	0.812		409.22	1935	1759	1583	1267	1056	880	704	528	352
48	0.875		440.38	2085	1896	1706	1365	1138	948	758	569	379
48	1.000		501.95	2383	2167	1950	1560	1300	1083	867	650	433

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
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EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
2	0.154	STD - 40	3.65	7989	7262	6536	5229	4357	3631	2905	2179	1452
2	0.218	XS - 80	5.02	11308	10280	9252	7402	6168	5140	4112	3084	2056
2	0.250		5.67	12968	11789	10611	8488	7074	5895	4716	3537	2358
2	0.344	160	7.46	17845	16222	14600	11680	9733	8111	6489	4867	3244
2	0.436	XXS	9.03	22617	20561	18505	14804	12337	10280	8224	6168	4112
3	0.125		4.51	4400	4000	3600	2880	2400	2000	1600	1200	800
3	0.156		5.57	5491	4992	4493	3594	2995	2496	1997	1498	998
3	0.188		6.65	6618	6016	5414	4332	3610	3008	2406	1805	1203
3	0.216	STD - 40	7.58	7603	6912	6221	4977	4147	3456	2765	2074	1382
3	0.250		8.68	8800	8000	7200	5760	4800	4000	3200	2400	1600
3	0.281		9.66	9891	8992	8093	6474	5395	4496	3597	2698	1798
3	0.300	XS - 80	10.25	10560	9600	8640	6912	5760	4800	3840	2880	1920
3	0.438	160	14.32	15418	14016	12614	10092	8410	7008	5606	4205	2803
3	0.600	XXS	18.58	21120	19200	17280	13824	11520	9600	7680	5760	3840
4	0.125		5.84	3422	3111	2800	2240	1867	1556	1244	933	622
4	0.141		6.56	3860	3509	3158	2527	2106	1755	1404	1053	702
4	0.156		7.24	4271	3883	3494	2796	2330	1941	1553	1165	777
4	0.172		7.95	4709	4281	3853	3082	2569	2140	1712	1284	856
4	0.188		8.66	5147	4679	4211	3369	2807	2340	1872	1404	936
4	0.203		9.32	5558	5052	4547	3638	3031	2526	2021	1516	1010
4	0.219		10.01	5996	5451	4906	3924	3270	2725	2180	1635	1090
4	0.237	STD - 40	10.79	6489	5899	5309	4247	3539	2949	2359	1770	1180
4	0.250		11.35	6844	6222	5600	4480	3733	3111	2489	1867	1244
4	0.281		12.66	7693	6994	6294	5036	4196	3497	2798	2098	1399
4	0.312		13.95	8542	7765	6989	5591	4659	3883	3106	2330	1553
4	0.337	XS - 80	14.98	9226	8388	7549	6039	5033	4194	3355	2516	1678
4	0.438	120	19.00	11991	10901	9811	7849	6541	5451	4361	3270	2180
4	0.500		21.36	13689	12444	11200	8960	7467	6222	4978	3733	2489
4	0.531	160	22.51	14538	13216	11894	9516	7930	6608	5286	3965	2643
4	0.674	XXS	27.54	18453	16775	15098	12078	10065	8388	6710	5033	3355
5	0.156		9.01	3455	3141	2827	2261	1884	1570	1256	942	628
5	0.188		10.79	4164	3785	3407	2725	2271	1893	1514	1136	757
5	0.219		12.50	4850	4409	3968	3175	2645	2205	1764	1323	882
5	0.258	STD - 40	14.62	5714	5194	4675	3740	3117	2597	2078	1558	1039
5	0.281		15.85	6223	5657	5092	4073	3394	2829	2263	1697	1131
5	0.312		17.50	6910	6282	5653	4523	3769	3141	2513	1884	1256
5	0.344		19.17	7618	6926	6233	4987	4155	3463	2770	2078	1385
5	0.375	XS - 80	20.78	8305	7550	6795	5436	4530	3775	3020	2265	1510
5	0.500	120	27.04	11073	10067	9060	7248	6040	5033	4027	3020	2013
5	0.625	160	32.96	13841	12583	11325	9060	7550	6292	5033	3775	2517
5	0.750	XXS	38.55	16610	15100	13590	10872	9060	7550	6040	4530	3020
6	0.156		10.78	2901	2637	2374	1899	1582	1319	1055	791	527
6	0.172		11.85	3199	2908	2617	2094	1745	1454	1163	872	582
6	0.188		12.92	3496	3178	2860	2288	1907	1589	1271	953	636
6	0.203		13.92	3775	3432	3089	2471	2059	1716	1373	1030	686
6	0.219		14.98	4073	3702	3332	2666	2221	1851	1481	1111	740
6	0.250		17.02	4649	4226	3804	3043	2536	2113	1691	1268	845
6	0.277		18.78	5151	4683	4215	3372	2810	2341	1873	1405	937
6	0.280	STD - 40	18.97	5207	4734	4260	3408	2840	2367	1893	1420	947
6	0.312		21.04	5802	5275	4747	3798	3165	2637	2110	1582	1055
6	0.344		23.08	6397	5816	5234	4187	3489	2908	2326	1745	1163
6	0.375		25.03	6974	6340	5706	4565	3804	3170	2536	1902	1268
6	0.432	XS - 80	28.57	8034	7303	6573	5258	4382	3652	2921	2191	1461
6	0.500		32.71	9298	8453	7608	6086	5072	4226	3381	2536	1691
6	0.562	120	36.39	10451	9501	8551	6841	5701	4750	3800	2850	1900
6	0.625		40.05	11623	10566	9509	7608	6340	5283	4226	3170	2113

EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
6	0.719	160	45.35	13371	12155	10940	8752	7293	6078	4862	3647	2431
6	0.864	XXS	53.16	16067	14606	13146	10517	8764	7303	5843	4382	2921
8	0.172		15.53	2457	2234	2010	1608	1340	1117	893	670	447
8	0.188		16.94	2685	2441	2197	1758	1465	1221	977	732	488
8	0.203		18.26	2900	2636	2372	1898	1582	1318	1054	791	527
8	0.219		19.66	3128	2844	2559	2048	1706	1422	1138	853	569
8	0.250		22.36	3571	3246	2922	2337	1948	1623	1299	974	649
8	0.277		24.70	3957	3597	3237	2590	2158	1798	1439	1079	719
8	0.312		27.70	4457	4051	3646	2917	2431	2026	1621	1215	810
8	0.322	STD - 40	28.55	4599	4181	3763	3011	2509	2091	1673	1254	836
8	0.344		30.42	4914	4467	4020	3216	2680	2234	1787	1340	893
8	0.375		33.04	5357	4870	4383	3506	2922	2435	1948	1461	974
8	0.406		35.64	5799	5272	4745	3796	3163	2636	2109	1582	1054
8	0.438		38.30	6256	5688	5119	4095	3413	2844	2275	1706	1138
8	0.500	XS - 80	43.39	7142	6493	5843	4675	3896	3246	2597	1948	1299
8	0.562		48.39	8028	7298	6568	5254	4379	3649	2919	2189	1460
8	0.594		50.95	8485	7713	6942	5554	4628	3857	3085	2314	1543
8	0.625		53.40	8928	8116	7304	5843	4870	4058	3246	2435	1623
8	0.719	120	60.71	10270	9337	8403	6722	5602	4668	3735	2801	1867
8	0.812		67.75	11599	10544	9490	7592	6327	5272	4218	3163	2109
8	0.875	XXS	72.42	12499	11362	10226	8181	6817	5681	4545	3409	2272
8	0.906	160	74.69	12941	11765	10588	8471	7059	5882	4706	3529	2353
10	0.188		21.21	2155	1959	1763	1410	1175	979	783	588	392
10	0.203		22.87	2326	2115	1903	1523	1269	1057	846	634	423
10	0.219		24.63	2510	2282	2054	1643	1369	1141	913	685	456
10	0.250		28.03	2865	2605	2344	1875	1563	1302	1042	781	521
10	0.279		31.20	3197	2907	2616	2093	1744	1453	1163	872	581
10	0.307		34.24	3518	3199	2879	2303	1919	1599	1279	960	640
10	0.344		38.23	3942	3584	3226	2580	2150	1792	1434	1075	717
10	0.365	STD - 40	40.48	4183	3803	3423	2738	2282	1901	1521	1141	761
10	0.438		48.24	5020	4563	4107	3286	2738	2282	1825	1369	913
10	0.500	XS	54.73	5730	5209	4688	3751	3126	2605	2084	1563	1042
10	0.562		61.15	6441	5855	5270	4216	3513	2928	2342	1757	1171
10	0.594	80	64.43	6808	6189	5570	4456	3713	3094	2475	1857	1238
10	0.625		67.58	7163	6512	5860	4688	3907	3256	2605	1953	1302
10	0.719		77.03	8240	7491	6742	5394	4495	3745	2996	2247	1498
10	0.750		80.10	8595	7814	7033	5626	4688	3907	3126	2344	1563
10	0.812		86.18	9306	8460	7614	6091	5076	4230	3384	2538	1692
10	0.844	120	89.29	9673	8793	7914	6331	5276	4397	3517	2638	1759
10	0.875		92.28	10028	9116	8205	6564	5470	4558	3647	2735	1823
10	1.000	XXS	104.13	11460	10419	9377	7501	6251	5209	4167	3126	2084
12	0.203		27.20	1962	1783	1605	1284	1070	892	713	535	357
12	0.219		29.31	2116	1924	1731	1385	1154	962	770	577	385
12	0.250		33.37	2416	2196	1976	1581	1318	1098	878	659	439
12	0.281		37.42	2715	2468	2222	1777	1481	1234	987	741	494
12	0.312		41.44	3015	2741	2467	1973	1644	1370	1096	822	548
12	0.330		43.77	3189	2899	2609	2087	1739	1449	1160	870	580
12	0.344		45.58	3324	3022	2720	2176	1813	1511	1209	907	604
12	0.375	STD	49.56	3624	3294	2965	2372	1976	1647	1318	988	659
12	0.406	40	53.52	3923	3566	3210	2568	2140	1783	1427	1070	713
12	0.438		57.59	4232	3848	3463	2770	2309	1924	1539	1154	770
12	0.500	XS	65.41	4831	4392	3953	3162	2635	2196	1757	1318	878
12	0.562		73.15	5430	4937	4443	3554	2962	2468	1975	1481	987
12	0.625		80.93	6039	5490	4941	3953	3294	2745	2196	1647	1098
12	0.688	80	88.63	6648	6044	5439	4351	3626	3022	2417	1813	1209
12	0.750		96.12	7247	6588	5929	4744	3953	3294	2635	1976	1318
12	0.844		107.32	8155	7414	6673	5338	4448	3707	2966	2224	1483

EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
12	0.875		110.97	8455	7686	6918	5534	4612	3843	3075	2306	1537
12	1.000	XXS - 120	125.49	9663	8784	7906	6325	5271	4392	3514	2635	1757
14	0.210		30.93	1848	1680	1512	1210	1008	840	672	504	336
14	0.219		32.23	1927	1752	1577	1261	1051	876	701	526	350
14	0.250		36.71	2200	2000	1800	1440	1200	1000	800	600	400
14	0.281		41.17	2473	2248	2023	1619	1349	1124	899	674	450
14	0.312		45.61	2746	2496	2246	1797	1498	1248	998	749	499
14	0.344		50.17	3027	2752	2477	1981	1651	1376	1101	826	550
14	0.375	STD	54.57	3300	3000	2700	2160	1800	1500	1200	900	600
14	0.438	40	63.44	3854	3504	3154	2523	2102	1752	1402	1051	701
14	0.469		67.77	4127	3752	3377	2701	2251	1876	1501	1126	750
14	0.500	XS	72.09	4400	4000	3600	2880	2400	2000	1600	1200	800
14	0.562		80.66	4946	4496	4046	3237	2698	2248	1798	1349	899
14	0.594		85.05	5227	4752	4277	3421	2851	2376	1901	1426	950
14	0.625		89.28	5500	5000	4500	3600	3000	2500	2000	1500	1000
14	0.688		97.81	6054	5504	4954	3963	3302	2752	2202	1651	1101
14	0.750	80	106.13	6600	6000	5400	4320	3600	3000	2400	1800	1200
14	0.812		114.37	7146	6496	5846	4677	3898	3248	2598	1949	1299
16	0.219		36.91	1686	1533	1380	1104	920	767	613	460	307
16	0.250		42.05	1925	1750	1575	1260	1050	875	700	525	350
16	0.281		47.17	2164	1967	1770	1416	1180	984	787	590	393
16	0.312		52.27	2402	2184	1966	1572	1310	1092	874	655	437
16	0.344		57.52	2649	2408	2167	1734	1445	1204	963	722	482
16	0.375	STD	62.58	2888	2625	2363	1890	1575	1313	1050	788	525
16	0.438		72.80	3373	3066	2759	2208	1840	1533	1226	920	613
16	0.469		77.79	3611	3283	2955	2364	1970	1642	1313	985	657
16	0.500	XXS - 40	82.77	3850	3500	3150	2520	2100	1750	1400	1050	700
16	0.562		92.66	4327	3934	3541	2832	2360	1967	1574	1180	787
16	0.625		102.63	4813	4375	3938	3150	2625	2188	1750	1313	875
16	0.656		107.50	5051	4592	4133	3306	2755	2296	1837	1378	918
16	0.688		112.51	5298	4816	4334	3468	2890	2408	1926	1445	963
16	0.750		122.15	5775	5250	4725	3780	3150	2625	2100	1575	1050
16	0.812		131.71	6252	5684	5116	4092	3410	2842	2274	1705	1137
16	0.844	80	136.61	6499	5908	5317	4254	3545	2954	2363	1772	1182
16	1.000		160.20	7700	7000	6300	5040	4200	3500	2800	2100	1400
18	0.250		47.39	1711	1556	1400	1120	933	778	622	467	311
18	0.281		53.18	1923	1748	1574	1259	1049	874	699	525	350
18	0.312		58.94	2135	1941	1747	1398	1165	971	777	582	388
18	0.344		64.87	2354	2140	1926	1541	1284	1070	856	642	428
18	0.375	STD	70.59	2567	2333	2100	1680	1400	1167	933	700	467
18	0.406		76.29	2779	2526	2274	1819	1516	1263	1010	758	505
18	0.438		82.15	2998	2725	2453	1962	1635	1363	1090	818	545
18	0.469		87.81	3210	2918	2626	2101	1751	1459	1167	875	584
18	0.500	XS	93.45	3422	3111	2800	2240	1867	1556	1244	933	622
18	0.562	40	104.66	3847	3497	3147	2518	2098	1748	1399	1049	699
18	0.625		115.98	4278	3889	3500	2800	2333	1944	1556	1167	778
18	0.688		127.20	4709	4281	3853	3082	2569	2140	1712	1284	856
18	0.750		138.17	5133	4667	4200	3360	2800	2333	1867	1400	933
18	0.812		149.05	5558	5052	4547	3638	3031	2526	2021	1516	1010
18	0.938	80	170.92	6420	5836	5253	4202	3502	2918	2335	1751	1167
18	1.000		181.56	6844	6222	5600	4480	3733	3111	2489	1867	1244
20	0.250		52.73	1540	1400	1260	1008	840	700	560	420	280
20	0.278		58.55	1712	1557	1401	1121	934	778	623	467	311
20	0.281		59.18	1731	1574	1416	1133	944	787	629	472	315
20	0.312		65.60	1922	1747	1572	1258	1048	874	699	524	349
20	0.334		70.15	2057	1870	1683	1347	1122	935	748	561	374

MiSource
Distribution Operations

Gas Standard

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EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
20	0.344		72.21	2119	1926	1734	1387	1156	963	771	578	385
20	0.347		72.83	2138	1943	1749	1399	1166	972	777	583	389
20	0.375	STD	78.60	2310	2100	1890	1512	1260	1050	840	630	420
20	0.406		84.96	2501	2274	2046	1637	1364	1137	909	682	455
20	0.417		87.21	2569	2335	2102	1681	1401	1168	934	701	467
20	0.438		91.51	2698	2453	2208	1766	1472	1226	981	736	491
20	0.462		96.40	2846	2587	2328	1863	1552	1294	1035	776	517
20	0.469		97.83	2889	2626	2364	1891	1576	1313	1051	788	525
20	0.500	XS	104.13	3080	2800	2520	2016	1680	1400	1120	840	560
20	0.562		116.67	3462	3147	2832	2266	1888	1574	1259	944	629
20	0.594	40	123.11	3659	3326	2994	2395	1996	1663	1331	998	665
20	0.625		129.33	3850	3500	3150	2520	2100	1750	1400	1050	700
20	0.688		141.90	4238	3853	3468	2774	2312	1926	1541	1156	771
20	0.750		154.19	4620	4200	3780	3024	2520	2100	1680	1260	840
20	0.812		166.40	5002	4547	4092	3274	2728	2274	1819	1364	909
20	1.000		202.92	6160	5600	5040	4032	3360	2800	2240	1680	1120
22	0.250		58.07	1400	1273	1145	916	764	636	509	382	255
22	0.281		65.18	1574	1431	1287	1030	858	715	572	429	286
22	0.312		72.27	1747	1588	1430	1144	953	794	635	477	318
22	0.344		79.56	1926	1751	1576	1261	1051	876	701	525	350
22	0.375	STD	86.61	2100	1909	1718	1375	1145	955	764	573	382
22	0.438		100.86	2453	2230	2007	1605	1338	1115	892	669	446
22	0.500	XS	114.81	2800	2545	2291	1833	1527	1273	1018	764	509
22	0.562		128.67	3147	2861	2575	2060	1717	1431	1144	858	572
22	0.625		142.68	3500	3182	2864	2291	1909	1591	1273	955	636
22	0.688		156.59	3853	3503	3152	2522	2102	1751	1401	1051	701
22	0.750		170.21	4200	3818	3436	2749	2291	1909	1527	1145	764
22	0.812		183.74	4547	4134	3720	2976	2480	2067	1654	1240	827
24	0.250		63.41	1283	1167	1050	840	700	583	467	350	233
24	0.257		65.17	1319	1199	1079	864	720	600	480	360	240
24	0.278		70.43	1427	1297	1168	934	778	649	519	389	259
24	0.281		71.18	1442	1311	1180	944	787	656	525	393	262
24	0.300		75.93	1540	1400	1260	1008	840	700	560	420	280
24	0.312		78.93	1602	1456	1310	1048	874	728	582	437	291
24	0.334		84.42	1715	1559	1403	1122	935	779	623	468	312
24	0.344		86.91	1766	1605	1445	1156	963	803	642	482	321
24	0.370		93.37	1899	1727	1554	1243	1036	863	691	518	345
24	0.375	STD	94.62	1925	1750	1575	1260	1050	875	700	525	350
24	0.406		102.30	2084	1895	1705	1364	1137	947	758	568	379
24	0.420		105.77	2156	1960	1764	1411	1176	980	784	588	392
24	0.438		110.22	2248	2044	1840	1472	1226	1022	818	613	409
24	0.469		117.86	2408	2189	1970	1576	1313	1094	875	657	438
24	0.500	XS	125.49	2567	2333	2100	1680	1400	1167	933	700	467
24	0.562		140.68	2885	2623	2360	1888	1574	1311	1049	787	525
24	0.625		156.03	3208	2917	2625	2100	1750	1458	1167	875	583
24	0.688	40	171.29	3532	3211	2890	2312	1926	1605	1284	963	642
24	0.750		186.23	3850	3500	3150	2520	2100	1750	1400	1050	700
24	0.812		201.09	4168	3789	3410	2728	2274	1895	1516	1137	758
24	1.000		245.64	5133	4667	4200	3360	2800	2333	1867	1400	933
26	0.250		68.75	1185	1077	969	775	646	538	431	323	215
26	0.278		76.37	1317	1198	1078	862	719	599	479	359	240
26	0.281		77.18	1332	1210	1089	872	726	605	484	363	242
26	0.301		82.61	1426	1297	1167	934	778	648	519	389	259
26	0.312		85.60	1478	1344	1210	968	806	672	538	403	269
26	0.334		91.55	1583	1439	1295	1036	863	719	576	432	288
26	0.344		94.26	1630	1482	1334	1067	889	741	593	445	296
26	0.361		98.85	1711	1555	1400	1120	933	778	622	467	311

EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
26	0.375	STD	102.63	1777	1615	1454	1163	969	808	646	485	323
26	0.406		110.98	1924	1749	1574	1259	1049	874	700	525	350
26	0.438		119.57	2075	1887	1698	1358	1132	943	755	566	377
26	0.469		127.88	2222	2020	1818	1455	1212	1010	808	606	404
26	0.500	XS	136.17	2369	2154	1938	1551	1292	1077	862	646	431
26	0.562		152.68	2663	2421	2179	1743	1453	1210	968	726	484
26	0.625		169.38	2962	2692	2423	1938	1615	1346	1077	808	538
26	0.688		185.99	3260	2964	2667	2134	1778	1482	1185	889	593
26	0.750		202.25	3554	3231	2908	2326	1938	1615	1292	969	646
26	0.875		234.79	4146	3769	3392	2714	2262	1885	1508	1131	754
26	1.000		267.00	4738	4308	3877	3102	2585	2154	1723	1292	862
28	0.250		74.09	1100	1000	900	720	600	500	400	300	200
28	0.281		83.19	1236	1124	1012	809	674	562	450	337	225
28	0.312		92.26	1373	1248	1123	899	749	624	499	374	250
28	0.344		101.60	1514	1376	1238	991	826	688	550	413	275
28	0.375	STD	110.64	1650	1500	1350	1080	900	750	600	450	300
28	0.406		119.65	1786	1624	1462	1169	974	812	650	487	325
28	0.438		128.93	1927	1752	1577	1261	1051	876	701	526	350
28	0.469		137.90	2064	1876	1688	1351	1126	938	750	563	375
28	0.500	XS	146.85	2200	2000	1800	1440	1200	1000	800	600	400
28	0.562		164.68	2473	2248	2023	1619	1349	1124	899	674	450
28	0.625		182.73	2750	2500	2250	1800	1500	1250	1000	750	500
30	0.281		89.19	1154	1049	944	755	629	525	420	315	210
30	0.300		95.16	1232	1120	1008	806	672	560	448	336	224
30	0.312		98.92	1281	1165	1048	839	699	582	466	349	233
30	0.321		101.75	1318	1198	1079	863	719	599	479	360	240
30	0.323		102.37	1326	1206	1085	868	724	603	482	362	241
30	0.325		103.00	1335	1213	1092	874	728	607	485	364	243
30	0.344		108.95	1413	1284	1156	925	771	642	514	385	257
30	0.347		109.89	1425	1295	1166	933	777	648	518	389	259
30	0.360		113.96	1478	1344	1210	968	806	672	538	403	269
30	0.375	STD	118.65	1540	1400	1260	1008	840	700	560	420	280
30	0.385		121.77	1581	1437	1294	1035	862	719	575	431	287
30	0.400		126.45	1643	1493	1344	1075	896	747	597	448	299
30	0.406		128.32	1667	1516	1364	1091	909	758	606	455	303
30	0.417		131.75	1712	1557	1401	1121	934	778	623	467	311
30	0.420		132.68	1725	1568	1411	1129	941	784	627	470	314
30	0.422		133.30	1733	1575	1418	1134	945	788	630	473	315
30	0.438		138.28	1799	1635	1472	1177	981	818	654	491	327
30	0.469		147.92	1926	1751	1576	1261	1051	875	700	525	350
30	0.480		151.33	1971	1792	1613	1290	1075	896	717	538	358
30	0.500	XS	157.53	2053	1867	1680	1344	1120	933	747	560	373
30	0.504		158.77	2070	1882	1693	1355	1129	941	753	564	376
30	0.525		165.26	2156	1960	1764	1411	1176	980	784	588	392
30	0.530		166.81	2177	1979	1781	1425	1187	989	791	594	396
30	0.562		176.69	2308	2098	1888	1511	1259	1049	839	629	420
30	0.563		177.00	2312	2102	1892	1513	1261	1051	841	631	420
30	0.625		196.08	2567	2333	2100	1680	1400	1167	933	700	467
30	0.750		234.29	3080	2800	2520	2016	1680	1400	1120	840	560
30	0.875		272.17	3593	3267	2940	2352	1960	1633	1307	980	653
30	1.000		309.72	4107	3733	3360	2688	2240	1867	1493	1120	747
30.2	0.423		134.52	1726	1569	1412	1129	941	784	627	471	314
32	0.250		84.77	963	875	788	630	525	438	350	263	175
32	0.281		95.19	1082	984	885	708	590	492	393	295	197
32	0.312		105.59	1201	1092	983	786	655	546	437	328	218
32	0.344		116.30	1324	1204	1084	867	722	602	482	361	241

EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
32	0.375	STD	126.66	1444	1313	1181	945	788	656	525	394	263
32	0.406		136.99	1563	1421	1279	1023	853	711	568	426	284
32	0.438		147.64	1686	1533	1380	1104	920	767	613	460	307
32	0.469		157.93	1806	1642	1477	1182	985	821	657	492	328
32	0.500	XS	168.21	1925	1750	1575	1260	1050	875	700	525	350
32	0.562		188.69	2164	1967	1770	1416	1180	984	787	590	393
32	0.625		209.43	2406	2188	1969	1575	1313	1094	875	656	438
34	0.250		90.11	906	824	741	593	494	412	329	247	165
34	0.281		101.19	1018	926	833	666	555	463	370	278	185
34	0.312		112.25	1131	1028	925	740	617	514	411	308	206
34	0.344		123.65	1246	1133	1020	816	680	567	453	340	227
34	0.375	STD	134.67	1359	1235	1112	889	741	618	494	371	247
34	0.406		145.66	1471	1337	1204	963	802	669	535	401	267
34	0.438		157.00	1587	1443	1299	1039	866	721	577	433	289
34	0.469		167.95	1699	1545	1390	1112	927	772	618	463	309
34	0.500	XS	178.89	1812	1647	1482	1186	988	824	659	494	329
34	0.562		200.70	2036	1851	1666	1333	1111	926	741	555	370
34	0.625		222.77	2265	2059	1853	1482	1235	1029	824	618	412
36	0.312		118.92	1068	971	874	699	582	485	388	291	194
36	0.344		131.00	1177	1070	963	771	642	535	428	321	214
36	0.356		135.52	1218	1108	997	797	665	554	443	332	222
36	0.375	STD	142.68	1283	1167	1050	840	700	583	467	350	233
36	0.385		146.44	1318	1198	1078	862	719	599	479	359	240
36	0.388		147.57	1328	1207	1086	869	724	604	483	362	241
36	0.406		154.34	1389	1263	1137	909	758	632	505	379	253
36	0.417		158.47	1427	1297	1168	934	778	649	519	389	259
36	0.438		166.35	1499	1363	1226	981	818	681	545	409	273
36	0.450		170.85	1540	1400	1260	1008	840	700	560	420	280
36	0.469		177.97	1605	1459	1313	1051	875	730	584	438	292
36	0.500	XS	189.57	1711	1556	1400	1120	933	778	622	467	311
36	0.504		191.06	1725	1568	1411	1129	941	784	627	470	314
36	0.525		198.91	1797	1633	1470	1176	980	817	653	490	327
36	0.540		204.50	1848	1680	1512	1210	1008	840	672	504	336
36	0.562		212.70	1923	1748	1574	1259	1049	874	699	525	350
36	0.600		226.84	2053	1867	1680	1344	1120	933	747	560	373
36	0.605		228.70	2070	1882	1694	1355	1129	941	753	565	376
36	0.625		236.12	2139	1944	1750	1400	1167	972	778	583	389
36	0.660		249.10	2259	2053	1848	1478	1232	1027	821	616	411
36	0.688		259.46	2354	2140	1926	1541	1284	1070	856	642	428
36	0.750		282.35	2567	2333	2100	1680	1400	1167	933	700	467
36	0.875		328.24	2994	2722	2450	1960	1633	1361	1089	817	544
36	1.000		373.79	3422	3111	2800	2240	1867	1556	1244	933	622
36.24	0.508		193.86	1727	1570	1413	1130	942	785	628	471	314
38	0.312		125.58	1012	920	828	662	552	460	368	276	184
38	0.344		138.34	1115	1014	913	730	608	507	406	304	203
38	0.375	STD	150.69	1216	1105	995	796	663	553	442	332	221
38	0.406		163.01	1316	1197	1077	862	718	598	479	359	239
38	0.438		175.71	1420	1291	1162	929	775	645	516	387	258
38	0.469		187.99	1521	1382	1244	995	829	691	553	415	276
38	0.500	XS	200.25	1621	1474	1326	1061	884	737	589	442	295
38	0.562		224.71	1822	1656	1491	1193	994	828	663	497	331
38	0.625		249.47	2026	1842	1658	1326	1105	921	737	553	368
40	0.344		145.69	1060	963	867	694	578	482	385	289	193
40	0.375	STD	158.70	1155	1050	945	756	630	525	420	315	210
40	0.406		171.68	1250	1137	1023	818	682	568	455	341	227

EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
40	0.438		185.06	1349	1226	1104	883	736	613	491	368	245
40	0.469		198.00	1445	1313	1182	946	788	657	525	394	263
40	0.500	XS	210.93	1540	1400	1260	1008	840	700	560	420	280
40	0.562		236.71	1731	1574	1416	1133	944	787	629	472	315
40	0.625		262.82	1925	1750	1575	1260	1050	875	700	525	350
42	0.312		138.91	915	832	749	599	499	416	333	250	166
42	0.323		143.77	947	861	775	620	517	431	345	258	172
42	0.344		153.04	1009	917	826	660	550	459	367	275	183
42	0.363		161.42	1065	968	871	697	581	484	387	290	194
42	0.375	STD	166.71	1100	1000	900	720	600	500	400	300	200
42	0.406		180.35	1191	1083	974	780	650	541	433	325	217
42	0.417		185.19	1223	1112	1001	801	667	556	445	334	222
42	0.438		194.42	1285	1168	1051	841	701	584	467	350	234
42	0.450		199.69	1320	1200	1080	864	720	600	480	360	240
42	0.469		208.02	1376	1251	1126	900	750	625	500	375	250
42	0.486		215.47	1426	1296	1166	933	778	648	518	389	259
42	0.500	XS	221.61	1467	1333	1200	960	800	667	533	400	267
42	0.562		248.71	1649	1499	1349	1079	899	749	599	450	300
42	0.625		276.17	1833	1667	1500	1200	1000	833	667	500	333
42	0.688		303.55	2018	1835	1651	1321	1101	917	734	550	367
42	0.750		330.41	2200	2000	1800	1440	1200	1000	800	600	400
42	0.812		357.18	2382	2165	1949	1559	1299	1083	866	650	433
42	0.875		384.31	2567	2333	2100	1680	1400	1167	933	700	467
42	1.000		437.87	2933	2667	2400	1920	1600	1333	1067	800	533
44	0.312		145.57	874	794	715	572	477	397	318	238	159
44	0.334		155.76	935	850	765	612	510	425	340	255	170
44	0.344		160.39	963	876	788	630	525	438	350	263	175
44	0.370		172.41	1036	942	848	678	565	471	377	283	188
44	0.375	STD	174.72	1050	955	859	687	573	477	382	286	191
44	0.406		189.02	1137	1033	930	744	620	517	413	310	207
44	0.417		194.10	1168	1061	955	764	637	531	425	318	212
44	0.438		203.77	1226	1115	1003	803	669	557	446	334	223
44	0.469		218.04	1313	1194	1074	860	716	597	478	358	239
44	0.476		221.26	1333	1212	1090	872	727	606	485	363	242
44	0.500	XS	232.29	1400	1273	1145	916	764	636	509	382	255
44	0.513		238.25	1436	1306	1175	940	783	653	522	392	261
44	0.556		257.97	1557	1415	1274	1019	849	708	566	425	283
44	0.562		260.72	1574	1431	1287	1030	858	715	572	429	286
44	0.625		289.52	1750	1591	1432	1145	955	795	636	477	318
44	0.688		318.25	1926	1751	1576	1261	1051	876	701	525	350
44	0.750		346.43	2100	1909	1718	1375	1145	955	764	573	382
44	0.812		374.53	2274	2067	1860	1488	1240	1033	827	620	413
44	0.875		403.00	2450	2227	2005	1604	1336	1114	891	668	445
44	1.000		459.23	2800	2545	2291	1833	1527	1273	1018	764	509
46	0.312		152.24	836	760	684	547	456	380	304	228	152
46	0.334		162.89	895	813	732	586	488	407	325	244	163
46	0.344		167.73	921	838	754	603	503	419	335	251	168
46	0.370		180.31	991	901	811	649	541	450	360	270	180
46	0.375	STD	182.73	1004	913	822	657	548	457	365	274	183
46	0.406		197.70	1087	989	890	712	593	494	395	297	198
46	0.417		203.00	1117	1015	914	731	609	508	406	305	203
46	0.438		213.13	1173	1066	960	768	640	533	427	320	213
46	0.469		228.06	1256	1142	1028	822	685	571	457	343	228
46	0.476		231.43	1275	1159	1043	834	695	579	464	348	232
46	0.500	XS	242.97	1339	1217	1096	877	730	609	487	365	243
46	0.513		249.21	1374	1249	1124	899	749	625	500	375	250
46	0.556		269.85	1489	1354	1218	975	812	677	541	406	271

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
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EXHIBIT B
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YIELD 56,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
46	0.562		272.72	1505	1368	1232	985	821	684	547	411	274
46	0.625		302.87	1674	1522	1370	1096	913	761	609	457	304
46	0.688		332.94	1843	1675	1508	1206	1005	838	670	503	335
46	0.750		362.45	2009	1826	1643	1315	1096	913	730	548	365
46	0.812		391.87	2175	1977	1779	1423	1186	989	791	593	395
46	0.875		421.69	2343	2130	1917	1534	1278	1065	852	639	426
46	1.000		480.59	2678	2435	2191	1753	1461	1217	974	730	487
48	0.312		158.90	801	728	655	524	437	364	291	218	146
48	0.334		170.03	857	779	701	561	468	390	312	234	156
48	0.344		175.08	883	803	722	578	482	401	321	241	161
48	0.370		188.21	950	863	777	622	518	432	345	259	173
48	0.375	STD	190.74	963	875	788	630	525	438	350	263	175
48	0.406		206.37	1042	947	853	682	568	474	379	284	189
48	0.417		211.91	1070	973	876	701	584	487	389	292	195
48	0.438		222.48	1124	1022	920	736	613	511	409	307	204
48	0.469		238.08	1204	1094	985	788	657	547	438	328	219
48	0.476		241.59	1222	1111	1000	800	666	555	444	333	222
48	0.500	XS	253.65	1283	1167	1050	840	700	583	467	350	233
48	0.513		260.17	1317	1197	1077	862	718	599	479	359	239
48	0.556		281.72	1427	1297	1168	934	778	649	519	389	259
48	0.562		284.73	1442	1311	1180	944	787	656	525	393	262
48	0.625		316.22	1604	1458	1313	1050	875	729	583	438	292
48	0.688		347.64	1766	1605	1445	1156	963	803	642	482	321
48	0.750		378.47	1925	1750	1575	1260	1050	875	700	525	350
48	0.812		409.22	2084	1895	1705	1364	1137	947	758	568	379
48	0.875		440.38	2246	2042	1838	1470	1225	1021	817	613	408
48	1.000		501.95	2567	2333	2100	1680	1400	1167	933	700	467

EXHIBIT B
(49 of 72)

YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
2	0.154	STD - 40	3.65	8559	7781	7003	5602	4669	3891	3112	2334	1556
2	0.218	XS - 80	5.02	12116	11015	9913	7931	6609	5507	4406	3304	2203
2	0.250		5.67	13895	12632	11368	9095	7579	6316	5053	3789	2526
2	0.344	160	7.46	19119	17381	15643	12514	10429	8691	6952	5214	3476
2	0.436	XXS	9.03	24232	22029	19827	15861	13218	11015	8812	6609	4406
3	0.125		4.51	4714	4286	3857	3086	2571	2143	1714	1286	857
3	0.156		5.57	5883	5349	4814	3851	3209	2674	2139	1605	1070
3	0.188		6.65	7090	6446	5801	4641	3867	3223	2578	1934	1289
3	0.216	STD - 40	7.58	8146	7406	6665	5332	4443	3703	2962	2222	1481
3	0.250		8.68	9429	8571	7714	6171	5143	4286	3429	2571	1714
3	0.281		9.66	10598	9634	8671	6937	5781	4817	3854	2890	1927
3	0.300	XS - 80	10.25	11314	10286	9257	7406	6171	5143	4114	3086	2057
3	0.438	160	14.32	16519	15017	13515	10812	9010	7509	6007	4505	3003
3	0.600	XXS	18.58	22629	20571	18514	14811	12343	10286	8229	6171	4114
4	0.125		5.84	3667	3333	3000	2400	2000	1667	1333	1000	667
4	0.141		6.56	4136	3760	3384	2707	2256	1880	1504	1128	752
4	0.156		7.24	4576	4160	3744	2995	2496	2080	1664	1248	832
4	0.172		7.95	5045	4587	4128	3302	2752	2293	1835	1376	917
4	0.188		8.66	5515	5013	4512	3610	3008	2507	2005	1504	1003
4	0.203		9.32	5955	5413	4872	3898	3248	2707	2165	1624	1083
4	0.219		10.01	6424	5840	5256	4205	3504	2920	2336	1752	1168
4	0.237	STD - 40	10.79	6952	6320	5688	4550	3792	3160	2528	1896	1264
4	0.250		11.35	7333	6667	6000	4800	4000	3333	2667	2000	1333
4	0.281		12.66	8243	7493	6744	5395	4496	3747	2997	2248	1499
4	0.312		13.95	9152	8320	7488	5990	4992	4160	3328	2496	1664
4	0.337	XS - 80	14.98	9885	8987	8088	6470	5392	4493	3595	2696	1797
4	0.438	120	19.00	12848	11680	10512	8410	7008	5840	4672	3504	2336
4	0.500		21.36	14667	13333	12000	9600	8000	6667	5333	4000	2667
4	0.531	160	22.51	15576	14160	12744	10195	8496	7080	5664	4248	2832
4	0.674	XXS	27.54	19771	17973	16176	12941	10784	8987	7189	5392	3595
5	0.156		9.01	3702	3365	3029	2423	2019	1683	1346	1010	673
5	0.188		10.79	4461	4055	3650	2920	2433	2028	1622	1217	811
5	0.219		12.50	5196	4724	4252	3401	2834	2362	1890	1417	945
5	0.258	STD - 40	14.62	6122	5565	5009	4007	3339	2783	2226	1670	1113
5	0.281		15.85	6668	6061	5455	4364	3637	3031	2425	1818	1212
5	0.312		17.50	7403	6730	6057	4846	4038	3365	2692	2019	1346
5	0.344		19.17	8163	7420	6678	5343	4452	3710	2968	2226	1484
5	0.375	XS - 80	20.78	8898	8089	7280	5824	4853	4045	3236	2427	1618
5	0.500	120	27.04	11864	10786	9707	7766	6471	5393	4314	3236	2157
5	0.625	160	32.96	14830	13482	12134	9707	8089	6741	5393	4045	2696
5	0.750	XXS	38.55	17796	16178	14560	11648	9707	8089	6471	4853	3236
6	0.156		10.78	3108	2826	2543	2034	1695	1413	1130	848	565
6	0.172		11.85	3427	3115	2804	2243	1869	1558	1246	935	623
6	0.188		12.92	3746	3405	3065	2452	2043	1703	1362	1022	681
6	0.203		13.92	4045	3677	3309	2647	2206	1838	1471	1103	735
6	0.219		14.98	4363	3967	3570	2856	2380	1983	1587	1190	793
6	0.250		17.02	4981	4528	4075	3260	2717	2264	1811	1358	906
6	0.277		18.78	5519	5017	4516	3612	3010	2509	2007	1505	1003
6	0.280	STD - 40	18.97	5579	5072	4565	3652	3043	2536	2029	1522	1014
6	0.312		21.04	6216	5651	5086	4069	3391	2826	2261	1695	1130
6	0.344		23.08	6854	6231	5608	4486	3739	3115	2492	1869	1246
6	0.375		25.03	7472	6792	6113	4891	4075	3396	2717	2038	1358
6	0.432	XS - 80	28.57	8607	7825	7042	5634	4695	3912	3130	2347	1565
6	0.500		32.71	9962	9057	8151	6521	5434	4528	3623	2717	1811
6	0.562	120	36.39	11198	10180	9162	7329	6108	5090	4072	3054	2036
6	0.625		40.05	12453	11321	10189	8151	6792	5660	4528	3396	2264

EXHIBIT B
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YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
6	0.719	160	45.35	14326	13023	11721	9377	7814	6512	5209	3907	2605
6	0.864	XXS	53.16	17215	15650	14085	11268	9390	7825	6260	4695	3130
8	0.172		15.53	2632	2393	2154	1723	1436	1197	957	718	479
8	0.188		16.94	2877	2616	2354	1883	1569	1308	1046	785	523
8	0.203		18.26	3107	2824	2542	2034	1695	1412	1130	847	565
8	0.219		19.66	3352	3047	2742	2194	1828	1523	1219	914	609
8	0.250		22.36	3826	3478	3130	2504	2087	1739	1391	1043	696
8	0.277		24.70	4239	3854	3469	2775	2312	1927	1542	1156	771
8	0.312		27.70	4775	4341	3907	3125	2605	2170	1736	1302	868
8	0.322	STD - 40	28.55	4928	4480	4032	3226	2688	2240	1792	1344	896
8	0.344		30.42	5265	4786	4307	3446	2872	2393	1914	1436	957
8	0.375		33.04	5739	5217	4696	3757	3130	2609	2087	1565	1043
8	0.406		35.64	6214	5649	5084	4067	3389	2824	2259	1695	1130
8	0.438		38.30	6703	6094	5485	4388	3656	3047	2438	1828	1219
8	0.500	XS - 80	43.39	7652	6957	6261	5009	4174	3478	2783	2087	1391
8	0.562		48.39	8601	7819	7037	5630	4691	3910	3128	2346	1564
8	0.594		50.95	9091	8264	7438	5950	4959	4132	3306	2479	1653
8	0.625		53.40	9565	8696	7826	6261	5217	4348	3478	2609	1739
8	0.719	120	60.71	11004	10003	9003	7203	6002	5002	4001	3001	2001
8	0.812		67.75	12427	11297	10168	8134	6778	5649	4519	3389	2259
8	0.875	XXS	72.42	13391	12174	10957	8765	7304	6087	4870	3652	2435
8	0.906	160	74.69	13866	12605	11345	9076	7563	6303	5042	3782	2521
10	0.188		21.21	2308	2099	1889	1511	1259	1049	839	630	420
10	0.203		22.87	2493	2266	2039	1632	1360	1133	906	680	453
10	0.219		24.63	2689	2445	2200	1760	1467	1222	978	733	489
10	0.250		28.03	3070	2791	2512	2009	1674	1395	1116	837	558
10	0.279		31.20	3426	3114	2803	2242	1869	1557	1246	934	623
10	0.307		34.24	3770	3427	3084	2467	2056	1713	1371	1028	685
10	0.344		38.23	4224	3840	3456	2765	2304	1920	1536	1152	768
10	0.365	STD - 40	40.48	4482	4074	3667	2934	2445	2037	1630	1222	815
10	0.438		48.24	5378	4889	4400	3520	2934	2445	1956	1467	978
10	0.500	XS	54.73	6140	5581	5023	4019	3349	2791	2233	1674	1116
10	0.562		61.15	6901	6273	5646	4517	3764	3137	2509	1882	1255
10	0.594	80	64.43	7294	6631	5968	4774	3978	3315	2652	1989	1326
10	0.625		67.58	7674	6977	6279	5023	4186	3488	2791	2093	1395
10	0.719		77.03	8829	8026	7223	5779	4816	4013	3210	2408	1605
10	0.750		80.10	9209	8372	7535	6028	5023	4186	3349	2512	1674
10	0.812		86.18	9971	9064	8158	6526	5439	4532	3626	2719	1813
10	0.844	120	89.29	10364	9421	8479	6783	5653	4711	3769	2826	1884
10	0.875		92.28	10744	9767	8791	7033	5860	4884	3907	2930	1953
10	1.000	XXS	104.13	12279	11163	10047	8037	6698	5581	4465	3349	2233
12	0.203		27.20	2102	1911	1720	1376	1146	955	764	573	382
12	0.219		29.31	2267	2061	1855	1484	1237	1031	824	618	412
12	0.250		33.37	2588	2353	2118	1694	1412	1176	941	706	471
12	0.281		37.42	2909	2645	2380	1904	1587	1322	1058	793	529
12	0.312		41.44	3230	2936	2643	2114	1762	1468	1175	881	587
12	0.330		43.77	3416	3106	2795	2236	1864	1553	1242	932	621
12	0.344		45.58	3561	3238	2914	2331	1943	1619	1295	971	648
12	0.375	STD	49.56	3882	3529	3176	2541	2118	1765	1412	1059	706
12	0.406	40	53.52	4203	3821	3439	2751	2293	1911	1528	1146	764
12	0.438		57.59	4535	4122	3710	2968	2473	2061	1649	1237	824
12	0.500	XS	65.41	5176	4706	4235	3388	2824	2353	1882	1412	941
12	0.562		73.15	5818	5289	4760	3808	3174	2645	2116	1587	1058
12	0.625		80.93	6471	5882	5294	4235	3529	2941	2353	1765	1176
12	0.688	80	88.63	7123	6475	5828	4662	3885	3238	2590	1943	1295
12	0.750		96.12	7765	7059	6353	5082	4235	3529	2824	2118	1412
12	0.844		107.32	8738	7944	7149	5719	4766	3972	3177	2383	1589

EXHIBIT B
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YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
12	0.875		110.97	9059	8235	7412	5929	4941	4118	3294	2471	1647
12	1.000	XXS - 120	125.49	10353	9412	8471	6776	5647	4706	3765	2824	1882
14	0.210		30.93	1980	1800	1620	1296	1080	900	720	540	360
14	0.219		32.23	2065	1877	1689	1352	1126	939	751	563	375
14	0.250		36.71	2357	2143	1929	1543	1286	1071	857	643	429
14	0.281		41.17	2649	2409	2168	1734	1445	1204	963	723	482
14	0.312		45.61	2942	2674	2407	1925	1605	1337	1070	802	535
14	0.344		50.17	3243	2949	2654	2123	1769	1474	1179	885	590
14	0.375	STD	54.57	3536	3214	2893	2314	1929	1607	1286	964	643
14	0.438	40	63.44	4130	3754	3379	2703	2253	1877	1502	1126	751
14	0.469		67.77	4422	4020	3618	2894	2412	2010	1608	1206	804
14	0.500	XS	72.09	4714	4286	3857	3086	2571	2143	1714	1286	857
14	0.562		80.66	5299	4817	4335	3468	2890	2409	1927	1445	963
14	0.594		85.05	5601	5091	4582	3666	3055	2546	2037	1527	1018
14	0.625		89.28	5893	5357	4821	3857	3214	2679	2143	1607	1071
14	0.688		97.81	6487	5897	5307	4246	3538	2949	2359	1769	1179
14	0.750	80	106.13	7071	6429	5786	4629	3857	3214	2571	1929	1286
14	0.812		114.37	7656	6960	6264	5011	4176	3480	2784	2088	1392
16	0.219		36.91	1807	1643	1478	1183	986	821	657	493	329
16	0.250		42.05	2063	1875	1688	1350	1125	938	750	563	375
16	0.281		47.17	2318	2108	1897	1517	1265	1054	843	632	422
16	0.312		52.27	2574	2340	2106	1685	1404	1170	936	702	468
16	0.344		57.52	2838	2580	2322	1858	1548	1290	1032	774	516
16	0.375	STD	62.58	3094	2813	2531	2025	1688	1406	1125	844	563
16	0.438		72.80	3614	3285	2957	2365	1971	1643	1314	986	657
16	0.469		77.79	3869	3518	3166	2533	2111	1759	1407	1055	704
16	0.500	XXS - 40	82.77	4125	3750	3375	2700	2250	1875	1500	1125	750
16	0.562		92.66	4637	4215	3794	3035	2529	2108	1686	1265	843
16	0.625		102.63	5156	4688	4219	3375	2813	2344	1875	1406	938
16	0.656		107.50	5412	4920	4428	3542	2952	2460	1968	1476	984
16	0.688		112.51	5676	5160	4644	3715	3096	2580	2064	1548	1032
16	0.750		122.15	6188	5625	5063	4050	3375	2813	2250	1688	1125
16	0.812		131.71	6699	6090	5481	4385	3654	3045	2436	1827	1218
16	0.844	80	136.61	6963	6330	5697	4558	3798	3165	2532	1899	1266
16	1.000		160.20	8250	7500	6750	5400	4500	3750	3000	2250	1500
18	0.250		47.39	1833	1667	1500	1200	1000	833	667	500	333
18	0.281		53.18	2061	1873	1686	1349	1124	937	749	562	375
18	0.312		58.94	2288	2080	1872	1498	1248	1040	832	624	416
18	0.344		64.87	2523	2293	2064	1651	1376	1147	917	688	459
18	0.375	STD	70.59	2750	2500	2250	1800	1500	1250	1000	750	500
18	0.406		76.29	2977	2707	2436	1949	1624	1353	1083	812	541
18	0.438		82.15	3212	2920	2628	2102	1752	1460	1168	876	584
18	0.469		87.81	3439	3127	2814	2251	1876	1563	1251	938	625
18	0.500	XS	93.45	3667	3333	3000	2400	2000	1667	1333	1000	667
18	0.562	40	104.66	4121	3747	3372	2698	2248	1873	1499	1124	749
18	0.625		115.98	4583	4167	3750	3000	2500	2083	1667	1250	833
18	0.688		127.20	5045	4587	4128	3302	2752	2293	1835	1376	917
18	0.750		138.17	5500	5000	4500	3600	3000	2500	2000	1500	1000
18	0.812		149.05	5955	5413	4872	3898	3248	2707	2165	1624	1083
18	0.938	80	170.92	6879	6253	5628	4502	3752	3127	2501	1876	1251
18	1.000		181.56	7333	6667	6000	4800	4000	3333	2667	2000	1333
20	0.250		52.73	1650	1500	1350	1080	900	750	600	450	300
20	0.278		58.55	1835	1668	1501	1201	1001	834	667	500	334
20	0.281		59.18	1855	1686	1517	1214	1012	843	674	506	337
20	0.312		65.60	2059	1872	1685	1348	1123	936	749	562	374
20	0.334		70.15	2204	2004	1804	1443	1202	1002	802	601	401

EXHIBIT B
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YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
20	0.344		72.21	2270	2064	1858	1486	1238	1032	826	619	413
20	0.347		72.83	2290	2082	1874	1499	1249	1041	833	625	416
20	0.375	STD	78.60	2475	2250	2025	1620	1350	1125	900	675	450
20	0.406		84.96	2680	2436	2192	1754	1462	1218	974	731	487
20	0.417		87.21	2752	2502	2252	1801	1501	1251	1001	751	500
20	0.438		91.51	2891	2628	2365	1892	1577	1314	1051	788	526
20	0.462		96.40	3049	2772	2495	1996	1663	1386	1109	832	554
20	0.469		97.83	3095	2814	2533	2026	1688	1407	1126	844	563
20	0.500	XS	104.13	3300	3000	2700	2160	1800	1500	1200	900	600
20	0.562		116.67	3709	3372	3035	2428	2023	1686	1349	1012	674
20	0.594	40	123.11	3920	3564	3208	2566	2138	1782	1426	1069	713
20	0.625		129.33	4125	3750	3375	2700	2250	1875	1500	1125	750
20	0.688		141.90	4541	4128	3715	2972	2477	2064	1651	1238	826
20	0.750		154.19	4950	4500	4050	3240	2700	2250	1800	1350	900
20	0.812		166.40	5359	4872	4385	3508	2923	2436	1949	1462	974
20	1.000		202.92	6600	6000	5400	4320	3600	3000	2400	1800	1200
22	0.250		58.07	1500	1364	1227	982	818	682	545	409	273
22	0.281		65.18	1686	1533	1379	1104	920	766	613	460	307
22	0.312		72.27	1872	1702	1532	1225	1021	851	681	511	340
22	0.344		79.56	2064	1876	1689	1351	1126	938	751	563	375
22	0.375	STD	86.61	2250	2045	1841	1473	1227	1023	818	614	409
22	0.438		100.86	2628	2389	2150	1720	1433	1195	956	717	478
22	0.500	XS	114.81	3000	2727	2455	1964	1636	1364	1091	818	545
22	0.562		128.67	3372	3065	2759	2207	1839	1533	1226	920	613
22	0.625		142.68	3750	3409	3068	2455	2045	1705	1364	1023	682
22	0.688		156.59	4128	3753	3377	2702	2252	1876	1501	1126	751
22	0.750		170.21	4500	4091	3682	2945	2455	2045	1636	1227	818
22	0.812		183.74	4872	4429	3986	3189	2657	2215	1772	1329	886
24	0.250		63.41	1375	1250	1125	900	750	625	500	375	250
24	0.257		65.17	1414	1285	1157	925	771	643	514	386	257
24	0.278		70.43	1529	1390	1251	1001	834	695	556	417	278
24	0.281		71.18	1546	1405	1265	1012	843	703	562	422	281
24	0.300		75.93	1650	1500	1350	1080	900	750	600	450	300
24	0.312		78.93	1716	1560	1404	1123	936	780	624	468	312
24	0.334		84.42	1837	1670	1503	1202	1002	835	668	501	334
24	0.344		86.91	1892	1720	1548	1238	1032	860	688	516	344
24	0.370		93.37	2035	1850	1665	1332	1110	925	740	555	370
24	0.375	STD	94.62	2063	1875	1688	1350	1125	938	750	563	375
24	0.406		102.30	2233	2030	1827	1462	1218	1015	812	609	406
24	0.420		105.77	2310	2100	1890	1512	1260	1050	840	630	420
24	0.438		110.22	2409	2190	1971	1577	1314	1095	876	657	438
24	0.469		117.86	2580	2345	2111	1688	1407	1173	938	704	469
24	0.500	XS	125.49	2750	2500	2250	1800	1500	1250	1000	750	500
24	0.562		140.68	3091	2810	2529	2023	1686	1405	1124	843	562
24	0.625		156.03	3438	3125	2813	2250	1875	1563	1250	938	625
24	0.688	40	171.29	3784	3440	3096	2477	2064	1720	1376	1032	688
24	0.750		186.23	4125	3750	3375	2700	2250	1875	1500	1125	750
24	0.812		201.09	4466	4060	3654	2923	2436	2030	1624	1218	812
24	1.000		245.64	5500	5000	4500	3600	3000	2500	2000	1500	1000
26	0.250		68.75	1269	1154	1038	831	692	577	462	346	231
26	0.278		76.37	1411	1283	1155	924	770	642	513	385	257
26	0.281		77.18	1427	1297	1167	934	778	648	519	389	259
26	0.301		82.61	1528	1389	1250	1000	834	695	556	417	278
26	0.312		85.60	1584	1440	1296	1037	864	720	576	432	288
26	0.334		91.55	1696	1542	1387	1110	925	771	617	462	308
26	0.344		94.26	1746	1588	1429	1143	953	794	635	476	318
26	0.361		98.85	1833	1666	1500	1200	1000	833	666	500	333

EXHIBIT B
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YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
26	0.375	STD	102.63	1904	1731	1558	1246	1038	865	692	519	346
26	0.406		110.98	2061	1874	1686	1349	1124	937	750	562	375
26	0.438		119.57	2224	2022	1819	1456	1213	1011	809	606	404
26	0.469		127.88	2381	2165	1948	1559	1299	1082	866	649	433
26	0.500	XS	136.17	2538	2308	2077	1662	1385	1154	923	692	462
26	0.562		152.68	2853	2594	2334	1868	1556	1297	1038	778	519
26	0.625		169.38	3173	2885	2596	2077	1731	1442	1154	865	577
26	0.688		185.99	3493	3175	2858	2286	1905	1588	1270	953	635
26	0.750		202.25	3808	3462	3115	2492	2077	1731	1385	1038	692
26	0.875		234.79	4442	4038	3635	2908	2423	2019	1615	1212	808
26	1.000		267.00	5077	4615	4154	3323	2769	2308	1846	1385	923
28	0.250		74.09	1179	1071	964	771	643	536	429	321	214
28	0.281		83.19	1325	1204	1084	867	723	602	482	361	241
28	0.312		92.26	1471	1337	1203	963	802	669	535	401	267
28	0.344		101.60	1622	1474	1327	1061	885	737	590	442	295
28	0.375	STD	110.64	1768	1607	1446	1157	964	804	643	482	321
28	0.406		119.65	1914	1740	1566	1253	1044	870	696	522	348
28	0.438		128.93	2065	1877	1689	1352	1126	939	751	563	375
28	0.469		137.90	2211	2010	1809	1447	1206	1005	804	603	402
28	0.500	XS	146.85	2357	2143	1929	1543	1286	1071	857	643	429
28	0.562		164.68	2649	2409	2168	1734	1445	1204	963	723	482
28	0.625		182.73	2946	2679	2411	1929	1607	1339	1071	804	536
30	0.281		89.19	1236	1124	1012	809	674	562	450	337	225
30	0.300		95.16	1320	1200	1080	864	720	600	480	360	240
30	0.312		98.92	1373	1248	1123	899	749	624	499	374	250
30	0.321		101.75	1412	1284	1156	924	770	642	514	385	257
30	0.323		102.37	1421	1292	1163	930	775	646	517	388	258
30	0.325		103.00	1430	1300	1170	936	780	650	520	390	260
30	0.344		108.95	1514	1376	1238	991	826	688	550	413	275
30	0.347		109.89	1527	1388	1249	999	833	694	555	416	278
30	0.360		113.96	1584	1440	1296	1037	864	720	576	432	288
30	0.375	STD	118.65	1650	1500	1350	1080	900	750	600	450	300
30	0.385		121.77	1694	1540	1386	1109	924	770	616	462	308
30	0.400		126.45	1760	1600	1440	1152	960	800	640	480	320
30	0.406		128.32	1786	1624	1462	1169	974	812	650	487	325
30	0.417		131.75	1835	1668	1501	1201	1001	834	667	500	334
30	0.420		132.68	1848	1680	1512	1210	1008	840	672	504	336
30	0.422		133.30	1857	1688	1519	1215	1013	844	675	506	338
30	0.438		138.28	1927	1752	1577	1261	1051	876	701	526	350
30	0.469		147.92	2064	1876	1688	1351	1126	938	750	563	375
30	0.480		151.33	2112	1920	1728	1382	1152	960	768	576	384
30	0.500	XS	157.53	2200	2000	1800	1440	1200	1000	800	600	400
30	0.504		158.77	2218	2016	1814	1452	1210	1008	806	605	403
30	0.525		165.26	2310	2100	1890	1512	1260	1050	840	630	420
30	0.530		166.81	2332	2120	1908	1526	1272	1060	848	636	424
30	0.562		176.69	2473	2248	2023	1619	1349	1124	899	674	450
30	0.563		177.00	2477	2252	2027	1621	1351	1126	901	676	450
30	0.625		196.08	2750	2500	2250	1800	1500	1250	1000	750	500
30	0.750		234.29	3300	3000	2700	2160	1800	1500	1200	900	600
30	0.875		272.17	3850	3500	3150	2520	2100	1750	1400	1050	700
30	1.000		309.72	4400	4000	3600	2880	2400	2000	1600	1200	800
30.2	0.423		134.52	1849	1681	1513	1210	1008	840	672	504	336
32	0.250		84.77	1031	938	844	675	563	469	375	281	188
32	0.281		95.19	1159	1054	948	759	632	527	422	316	211
32	0.312		105.59	1287	1170	1053	842	702	585	468	351	234
32	0.344		116.30	1419	1290	1161	929	774	645	516	387	258

EXHIBIT B
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YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
32	0.375	STD	126.66	1547	1406	1266	1013	844	703	563	422	281
32	0.406		136.99	1675	1523	1370	1096	914	761	609	457	305
32	0.438		147.64	1807	1643	1478	1183	986	821	657	493	329
32	0.469		157.93	1935	1759	1583	1266	1055	879	704	528	352
32	0.500	XS	168.21	2063	1875	1688	1350	1125	938	750	563	375
32	0.562		188.69	2318	2108	1897	1517	1265	1054	843	632	422
32	0.625		209.43	2578	2344	2109	1688	1406	1172	938	703	469
34	0.250		90.11	971	882	794	635	529	441	353	265	176
34	0.281		101.19	1091	992	893	714	595	496	397	298	198
34	0.312		112.25	1211	1101	991	793	661	551	440	330	220
34	0.344		123.65	1336	1214	1093	874	728	607	486	364	243
34	0.375	STD	134.67	1456	1324	1191	953	794	662	529	397	265
34	0.406		145.66	1576	1433	1290	1032	860	716	573	430	287
34	0.438		157.00	1700	1546	1391	1113	928	773	618	464	309
34	0.469		167.95	1821	1655	1490	1192	993	828	662	497	331
34	0.500	XS	178.89	1941	1765	1588	1271	1059	882	706	529	353
34	0.562		200.70	2182	1984	1785	1428	1190	992	793	595	397
34	0.625		222.77	2426	2206	1985	1588	1324	1103	882	662	441
36	0.312		118.92	1144	1040	936	749	624	520	416	312	208
36	0.344		131.00	1261	1147	1032	826	688	573	459	344	229
36	0.356		135.52	1305	1187	1068	854	712	593	475	356	237
36	0.375	STD	142.68	1375	1250	1125	900	750	625	500	375	250
36	0.385		146.44	1412	1283	1155	924	770	642	513	385	257
36	0.388		147.57	1423	1293	1164	931	776	647	517	388	259
36	0.406		154.34	1489	1353	1218	974	812	677	541	406	271
36	0.417		158.47	1529	1390	1251	1001	834	695	556	417	278
36	0.438		166.35	1606	1460	1314	1051	876	730	584	438	292
36	0.450		170.85	1650	1500	1350	1080	900	750	600	450	300
36	0.469		177.97	1720	1563	1407	1126	938	782	625	469	313
36	0.500	XS	189.57	1833	1667	1500	1200	1000	833	667	500	333
36	0.504		191.06	1848	1680	1512	1210	1008	840	672	504	336
36	0.525		198.91	1925	1750	1575	1260	1050	875	700	525	350
36	0.540		204.50	1980	1800	1620	1296	1080	900	720	540	360
36	0.562		212.70	2061	1873	1686	1349	1124	937	749	562	375
36	0.600		226.84	2200	2000	1800	1440	1200	1000	800	600	400
36	0.605		228.70	2218	2017	1815	1452	1210	1008	807	605	403
36	0.625		236.12	2292	2083	1875	1500	1250	1042	833	625	417
36	0.660		249.10	2420	2200	1980	1584	1320	1100	880	660	440
36	0.688		259.46	2523	2293	2064	1651	1376	1147	917	688	459
36	0.750		282.35	2750	2500	2250	1800	1500	1250	1000	750	500
36	0.875		328.24	3208	2917	2625	2100	1750	1458	1167	875	583
36	1.000		373.79	3667	3333	3000	2400	2000	1667	1333	1000	667
36.24	0.508		193.86	1850	1682	1514	1211	1009	841	673	505	336
38	0.312		125.58	1084	985	887	709	591	493	394	296	197
38	0.344		138.34	1195	1086	978	782	652	543	435	326	217
38	0.375	STD	150.69	1303	1184	1066	853	711	592	474	355	237
38	0.406		163.01	1410	1282	1154	923	769	641	513	385	256
38	0.438		175.71	1521	1383	1245	996	830	692	553	415	277
38	0.469		187.99	1629	1481	1333	1066	889	741	592	444	296
38	0.500	XS	200.25	1737	1579	1421	1137	947	789	632	474	316
38	0.562		224.71	1952	1775	1597	1278	1065	887	710	532	355
38	0.625		249.47	2171	1974	1776	1421	1184	987	789	592	395
40	0.344		145.69	1135	1032	929	743	619	516	413	310	206
40	0.375	STD	158.70	1238	1125	1013	810	675	563	450	338	225
40	0.406		171.68	1340	1218	1096	877	731	609	487	365	244

EXHIBIT B
(55 of 72)

YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
40	0.438		185.06	1445	1314	1183	946	788	657	526	394	263
40	0.469		198.00	1548	1407	1266	1013	844	704	563	422	281
40	0.500	XS	210.93	1650	1500	1350	1080	900	750	600	450	300
40	0.562		236.71	1855	1686	1517	1214	1012	843	674	506	337
40	0.625		262.82	2063	1875	1688	1350	1125	938	750	563	375
42	0.312		138.91	981	891	802	642	535	446	357	267	178
42	0.323		143.77	1015	923	831	664	554	461	369	277	185
42	0.344		153.04	1081	983	885	708	590	491	393	295	197
42	0.363		161.42	1141	1037	933	747	622	519	415	311	207
42	0.375	STD	166.71	1179	1071	964	771	643	536	429	321	214
42	0.406		180.35	1276	1160	1044	835	696	580	464	348	232
42	0.417		185.19	1311	1191	1072	858	715	596	477	357	238
42	0.438		194.42	1377	1251	1126	901	751	626	501	375	250
42	0.450		199.69	1414	1286	1157	926	771	643	514	386	257
42	0.469		208.02	1474	1340	1206	965	804	670	536	402	268
42	0.486		215.47	1527	1389	1250	1000	833	694	555	417	278
42	0.500	XS	221.61	1571	1429	1286	1029	857	714	571	429	286
42	0.562		248.71	1766	1606	1445	1156	963	803	642	482	321
42	0.625		276.17	1964	1786	1607	1286	1071	893	714	536	357
42	0.688		303.55	2162	1966	1769	1415	1179	983	786	590	393
42	0.750		330.41	2357	2143	1929	1543	1286	1071	857	643	429
42	0.812		357.18	2552	2320	2088	1670	1392	1160	928	696	464
42	0.875		384.31	2750	2500	2250	1800	1500	1250	1000	750	500
42	1.000		437.87	3143	2857	2571	2057	1714	1429	1143	857	571
44	0.312		145.57	936	851	766	613	511	425	340	255	170
44	0.334		155.76	1002	911	820	656	547	455	364	273	182
44	0.344		160.39	1032	938	844	675	563	469	375	281	188
44	0.370		172.41	1110	1009	908	727	605	505	404	303	202
44	0.375	STD	174.72	1125	1023	920	736	614	511	409	307	205
44	0.406		189.02	1218	1107	997	797	664	554	443	332	221
44	0.417		194.10	1251	1137	1024	819	682	569	455	341	227
44	0.438		203.77	1314	1195	1075	860	717	597	478	358	239
44	0.469		218.04	1407	1279	1151	921	767	640	512	384	256
44	0.476		221.26	1428	1298	1168	935	779	649	519	389	260
44	0.500	XS	232.29	1500	1364	1227	982	818	682	545	409	273
44	0.513		238.25	1539	1399	1259	1007	839	700	560	420	280
44	0.556		257.97	1668	1516	1365	1092	910	758	607	455	303
44	0.562		260.72	1686	1533	1379	1104	920	766	613	460	307
44	0.625		289.52	1875	1705	1534	1227	1023	852	682	511	341
44	0.688		318.25	2064	1876	1689	1351	1126	938	751	563	375
44	0.750		346.43	2250	2045	1841	1473	1227	1023	818	614	409
44	0.812		374.53	2436	2215	1993	1594	1329	1107	886	664	443
44	0.875		403.00	2625	2386	2148	1718	1432	1193	955	716	477
44	1.000		459.23	3000	2727	2455	1964	1636	1364	1091	818	545
46	0.312		152.24	895	814	733	586	488	407	326	244	163
46	0.334		162.89	958	871	784	627	523	436	349	261	174
46	0.344		167.73	987	897	808	646	538	449	359	269	179
46	0.370		180.31	1062	965	869	695	579	483	386	290	193
46	0.375	STD	182.73	1076	978	880	704	587	489	391	293	196
46	0.406		197.70	1165	1059	953	763	635	530	424	318	212
46	0.417		203.00	1197	1088	979	783	653	544	435	326	218
46	0.438		213.13	1257	1143	1028	823	686	571	457	343	229
46	0.469		228.06	1346	1223	1101	881	734	612	489	367	245
46	0.476		231.43	1366	1242	1118	894	745	621	497	373	248
46	0.500	XS	242.97	1435	1304	1174	939	783	652	522	391	261
46	0.513		249.21	1472	1338	1204	964	803	669	535	401	268
46	0.556		269.85	1595	1450	1305	1044	870	725	580	435	290

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 71 of 87

EXHIBIT B
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YIELD 60,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
46	0.562		272.72	1613	1466	1319	1056	880	733	586	440	293
46	0.625		302.87	1793	1630	1467	1174	978	815	652	489	326
46	0.688		332.94	1974	1795	1615	1292	1077	897	718	538	359
46	0.750		362.45	2152	1957	1761	1409	1174	978	783	587	391
46	0.812		391.87	2330	2118	1906	1525	1271	1059	847	635	424
46	0.875		421.69	2511	2283	2054	1643	1370	1141	913	685	457
46	1.000		480.59	2870	2609	2348	1878	1565	1304	1043	783	522
48	0.312		158.90	858	780	702	562	468	390	312	234	156
48	0.334		170.03	919	835	752	601	501	418	334	251	167
48	0.344		175.08	946	860	774	619	516	430	344	258	172
48	0.370		188.21	1018	925	833	666	555	463	370	278	185
48	0.375	STD	190.74	1031	938	844	675	563	469	375	281	188
48	0.406		206.37	1117	1015	914	731	609	508	406	305	203
48	0.417		211.91	1147	1043	938	751	626	521	417	313	209
48	0.438		222.48	1205	1095	986	788	657	548	438	329	219
48	0.469		238.08	1290	1173	1055	844	704	586	469	352	235
48	0.476		241.59	1309	1190	1071	857	714	595	476	357	238
48	0.500	XS	253.65	1375	1250	1125	900	750	625	500	375	250
48	0.513		260.17	1411	1283	1154	923	770	641	513	385	257
48	0.556		281.72	1529	1390	1251	1001	834	695	556	417	278
48	0.562		284.73	1546	1405	1265	1012	843	703	562	422	281
48	0.625		316.22	1719	1563	1406	1125	938	781	625	469	313
48	0.688		347.64	1892	1720	1548	1238	1032	860	688	516	344
48	0.750		378.47	2063	1875	1688	1350	1125	938	750	563	375
48	0.812		409.22	2233	2030	1827	1462	1218	1015	812	609	406
48	0.875		440.38	2406	2188	1969	1575	1313	1094	875	656	438
48	1.000		501.95	2750	2500	2250	1800	1500	1250	1000	750	500

EXHIBIT B
(57 of 72)

YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
2	0.154	STD - 40	3.65	9272	8429	7587	6069	5058	4215	3372	2529	1686
2	0.218	XS - 80	5.02	13126	11933	10739	8591	7160	5966	4773	3580	2387
2	0.250		5.67	15053	13684	12316	9853	8211	6842	5474	4105	2737
2	0.344	160	7.46	20712	18829	16947	13557	11298	9415	7532	5649	3766
2	0.436	XXS	9.03	26252	23865	21479	17183	14319	11933	9546	7160	4773
3	0.125		4.51	5107	4643	4179	3343	2786	2321	1857	1393	929
3	0.156		5.57	6374	5794	5215	4172	3477	2897	2318	1738	1159
3	0.188		6.65	7681	6983	6285	5028	4190	3491	2793	2095	1397
3	0.216	STD - 40	7.58	8825	8023	7221	5776	4814	4011	3209	2407	1605
3	0.250		8.68	10214	9286	8357	6686	5571	4643	3714	2786	1857
3	0.281		9.66	11481	10437	9393	7515	6262	5219	4175	3131	2087
3	0.300	XS - 80	10.25	12257	11143	10029	8023	6686	5571	4457	3343	2229
3	0.438	160	14.32	17895	16269	14642	11713	9761	8134	6507	4881	3254
3	0.600	XXS	18.58	24514	22286	20057	16046	13371	11143	8914	6686	4457
4	0.125		5.84	3972	3611	3250	2600	2167	1806	1444	1083	722
4	0.141		6.56	4481	4073	3666	2933	2444	2037	1629	1222	815
4	0.156		7.24	4957	4507	4056	3245	2704	2253	1803	1352	901
4	0.172		7.95	5466	4969	4472	3578	2981	2484	1988	1491	994
4	0.188		8.66	5974	5431	4888	3910	3259	2716	2172	1629	1086
4	0.203		9.32	6451	5864	5278	4222	3519	2932	2346	1759	1173
4	0.219		10.01	6959	6327	5694	4555	3796	3163	2531	1898	1265
4	0.237	STD - 40	10.79	7531	6847	6162	4930	4108	3423	2739	2054	1369
4	0.250		11.35	7944	7222	6500	5200	4333	3611	2889	2167	1444
4	0.281		12.66	8930	8118	7306	5845	4871	4059	3247	2435	1624
4	0.312		13.95	9915	9013	8112	6490	5408	4507	3605	2704	1803
4	0.337	XS - 80	14.98	10709	9736	8762	7010	5841	4868	3894	2921	1947
4	0.438	120	19.00	13919	12653	11388	9110	7592	6327	5061	3796	2531
4	0.500		21.36	15889	14444	13000	10400	8667	7222	5778	4333	2889
4	0.531	160	22.51	16874	15340	13806	11045	9204	7670	6136	4602	3068
4	0.674	XXS	27.54	21418	19471	17524	14019	11683	9736	7788	5841	3894
5	0.156		9.01	4010	3646	3281	2625	2187	1823	1458	1094	729
5	0.188		10.79	4833	4393	3954	3163	2636	2197	1757	1318	879
5	0.219		12.50	5630	5118	4606	3685	3071	2559	2047	1535	1024
5	0.258	STD - 40	14.62	6632	6029	5426	4341	3617	3015	2412	1809	1206
5	0.281		15.85	7223	6567	5910	4728	3940	3283	2627	1970	1313
5	0.312		17.50	8020	7291	6562	5250	4375	3646	2916	2187	1458
5	0.344		19.17	8843	8039	7235	5788	4823	4019	3216	2412	1608
5	0.375	XS - 80	20.78	9640	8763	7887	6310	5258	4382	3505	2629	1753
5	0.500	120	27.04	12853	11684	10516	8413	7011	5842	4674	3505	2337
5	0.625	160	32.96	16066	14605	13145	10516	8763	7303	5842	4382	2921
5	0.750	XXS	38.55	19279	17527	15774	12619	10516	8763	7011	5258	3505
6	0.156		10.78	3367	3061	2755	2204	1837	1531	1224	918	612
6	0.172		11.85	3713	3375	3038	2430	2025	1688	1350	1013	675
6	0.188		12.92	4058	3689	3320	2656	2213	1845	1476	1107	738
6	0.203		13.92	4382	3983	3585	2868	2390	1992	1593	1195	797
6	0.219		14.98	4727	4297	3868	3094	2578	2149	1719	1289	859
6	0.250		17.02	5396	4906	4415	3532	2943	2453	1962	1472	981
6	0.277		18.78	5979	5435	4892	3914	3261	2718	2174	1631	1087
6	0.280	STD - 40	18.97	6044	5494	4945	3956	3297	2747	2198	1648	1099
6	0.312		21.04	6734	6122	5510	4408	3673	3061	2449	1837	1224
6	0.344		23.08	7425	6750	6075	4860	4050	3375	2700	2025	1350
6	0.375		25.03	8094	7358	6623	5298	4415	3679	2943	2208	1472
6	0.432	XS - 80	28.57	9325	8477	7629	6103	5086	4238	3391	2543	1695
6	0.500		32.71	10792	9811	8830	7064	5887	4906	3925	2943	1962
6	0.562	120	36.39	12131	11028	9925	7940	6617	5514	4411	3308	2206
6	0.625		40.05	13491	12264	11038	8830	7358	6132	4906	3679	2453

EXHIBIT B
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YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
6	0.719	160	45.35	15520	14109	12698	10158	8465	7054	5643	4233	2822
6	0.864	XXS	53.16	18649	16954	15259	12207	10172	8477	6782	5086	3391
8	0.172		15.53	2852	2592	2333	1867	1555	1296	1037	778	518
8	0.188		16.94	3117	2834	2550	2040	1700	1417	1133	850	567
8	0.203		18.26	3366	3060	2754	2203	1836	1530	1224	918	612
8	0.219		19.66	3631	3301	2971	2377	1981	1650	1320	990	660
8	0.250		22.36	4145	3768	3391	2713	2261	1884	1507	1130	754
8	0.277		24.70	4593	4175	3758	3006	2505	2088	1670	1253	835
8	0.312		27.70	5173	4703	4232	3386	2822	2351	1881	1411	941
8	0.322	STD - 40	28.55	5339	4853	4368	3494	2912	2427	1941	1456	971
8	0.344		30.42	5703	5185	4666	3733	3111	2592	2074	1555	1037
8	0.375		33.04	6217	5652	5087	4070	3391	2826	2261	1696	1130
8	0.406		35.64	6731	6119	5507	4406	3672	3060	2448	1836	1224
8	0.438		38.30	7262	6602	5942	4753	3961	3301	2641	1981	1320
8	0.500	XS - 80	43.39	8290	7536	6783	5426	4522	3768	3014	2261	1507
8	0.562		48.39	9318	8471	7624	6099	5082	4235	3388	2541	1694
8	0.594		50.95	9848	8953	8058	6446	5372	4477	3581	2686	1791
8	0.625		53.40	10362	9420	8478	6783	5652	4710	3768	2826	1884
8	0.719	120	60.71	11921	10837	9753	7803	6502	5419	4335	3251	2167
8	0.812		67.75	13463	12239	11015	8812	7343	6119	4896	3672	2448
8	0.875	XXS	72.42	14507	13188	11870	9496	7913	6594	5275	3957	2638
8	0.906	160	74.69	15021	13656	12290	9832	8193	6828	5462	4097	2731
10	0.188		21.21	2501	2273	2046	1637	1364	1137	909	682	455
10	0.203		22.87	2700	2455	2209	1768	1473	1227	982	736	491
10	0.219		24.63	2913	2648	2384	1907	1589	1324	1059	795	530
10	0.250		28.03	3326	3023	2721	2177	1814	1512	1209	907	605
10	0.279		31.20	3711	3374	3037	2429	2024	1687	1350	1012	675
10	0.307		34.24	4084	3713	3341	2673	2228	1856	1485	1114	743
10	0.344		38.23	4576	4160	3744	2995	2496	2080	1664	1248	832
10	0.365	STD - 40	40.48	4855	4414	3973	3178	2648	2207	1766	1324	883
10	0.438		48.24	5826	5297	4767	3814	3178	2648	2119	1589	1059
10	0.500	XS	54.73	6651	6047	5442	4353	3628	3023	2419	1814	1209
10	0.562		61.15	7476	6796	6117	4893	4078	3398	2719	2039	1359
10	0.594	80	64.43	7902	7183	6465	5172	4310	3592	2873	2155	1437
10	0.625		67.58	8314	7558	6802	5442	4535	3779	3023	2267	1512
10	0.719		77.03	9564	8695	7825	6260	5217	4347	3478	2608	1739
10	0.750		80.10	9977	9070	8163	6530	5442	4535	3628	2721	1814
10	0.812		86.18	10801	9820	8838	7070	5892	4910	3928	2946	1964
10	0.844	120	89.29	11227	10207	9186	7349	6124	5103	4083	3062	2041
10	0.875		92.28	11640	10581	9523	7619	6349	5291	4233	3174	2116
10	1.000	XXS	104.13	13302	12093	10884	8707	7256	6047	4837	3628	2419
12	0.203		27.20	2277	2070	1863	1490	1242	1035	828	621	414
12	0.219		29.31	2456	2233	2010	1608	1340	1116	893	670	447
12	0.250		33.37	2804	2549	2294	1835	1529	1275	1020	765	510
12	0.281		37.42	3152	2865	2579	2063	1719	1433	1146	860	573
12	0.312		41.44	3499	3181	2863	2290	1909	1591	1272	954	636
12	0.330		43.77	3701	3365	3028	2423	2019	1682	1346	1009	673
12	0.344		45.58	3858	3507	3157	2525	2104	1754	1403	1052	701
12	0.375	STD	49.56	4206	3824	3441	2753	2294	1912	1529	1147	765
12	0.406	40	53.52	4554	4140	3726	2981	2484	2070	1656	1242	828
12	0.438		57.59	4912	4466	4019	3215	2680	2233	1786	1340	893
12	0.500	XS	65.41	5608	5098	4588	3671	3059	2549	2039	1529	1020
12	0.562		73.15	6303	5730	5157	4126	3438	2865	2292	1719	1146
12	0.625		80.93	7010	6373	5735	4588	3824	3186	2549	1912	1275
12	0.688	80	88.63	7716	7015	6313	5051	4209	3507	2806	2104	1403
12	0.750		96.12	8412	7647	6882	5506	4588	3824	3059	2294	1529
12	0.844		107.32	9466	8605	7745	6196	5163	4303	3442	2582	1721

EXHIBIT B
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YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
12	0.875		110.97	9814	8922	8029	6424	5353	4461	3569	2676	1784
12	1.000	XXS - 120	125.49	11216	10196	9176	7341	6118	5098	4078	3059	2039
14	0.210		30.93	2145	1950	1755	1404	1170	975	780	585	390
14	0.219		32.23	2237	2034	1830	1464	1220	1017	813	610	407
14	0.250		36.71	2554	2321	2089	1671	1393	1161	929	696	464
14	0.281		41.17	2870	2609	2348	1879	1566	1305	1044	783	522
14	0.312		45.61	3187	2897	2607	2086	1738	1449	1159	869	579
14	0.344		50.17	3514	3194	2875	2300	1917	1597	1278	958	639
14	0.375	STD	54.57	3830	3482	3134	2507	2089	1741	1393	1045	696
14	0.438	40	63.44	4474	4067	3660	2928	2440	2034	1627	1220	813
14	0.469		67.77	4791	4355	3920	3136	2613	2178	1742	1307	871
14	0.500	XS	72.09	5107	4643	4179	3343	2786	2321	1857	1393	929
14	0.562		80.66	5740	5219	4697	3757	3131	2609	2087	1566	1044
14	0.594		85.05	6067	5516	4964	3971	3309	2758	2206	1655	1103
14	0.625		89.28	6384	5804	5223	4179	3482	2902	2321	1741	1161
14	0.688		97.81	7027	6389	5750	4600	3833	3194	2555	1917	1278
14	0.750	80	106.13	7661	6964	6268	5014	4179	3482	2786	2089	1393
14	0.812		114.37	8294	7540	6786	5429	4524	3770	3016	2262	1508
16	0.219		36.91	1957	1779	1601	1281	1068	890	712	534	356
16	0.250		42.05	2234	2031	1828	1463	1219	1016	813	609	406
16	0.281		47.17	2511	2283	2055	1644	1370	1142	913	685	457
16	0.312		52.27	2789	2535	2282	1825	1521	1268	1014	761	507
16	0.344		57.52	3075	2795	2516	2012	1677	1398	1118	839	559
16	0.375	STD	62.58	3352	3047	2742	2194	1828	1523	1219	914	609
16	0.438		72.80	3915	3559	3203	2562	2135	1779	1424	1068	712
16	0.469		77.79	4192	3811	3430	2744	2286	1905	1524	1143	762
16	0.500	XXS - 40	82.77	4469	4063	3656	2925	2438	2031	1625	1219	813
16	0.562		92.66	5023	4566	4110	3288	2740	2283	1827	1370	913
16	0.625		102.63	5586	5078	4570	3656	3047	2539	2031	1523	1016
16	0.656		107.50	5863	5330	4797	3838	3198	2665	2132	1599	1066
16	0.688		112.51	6149	5590	5031	4025	3354	2795	2236	1677	1118
16	0.750		122.15	6703	6094	5484	4388	3656	3047	2438	1828	1219
16	0.812		131.71	7257	6598	5938	4750	3959	3299	2639	1979	1320
16	0.844	80	136.61	7543	6858	6172	4937	4115	3429	2743	2057	1372
16	1.000		160.20	8938	8125	7313	5850	4875	4063	3250	2438	1625
18	0.250		47.39	1986	1806	1625	1300	1083	903	722	542	361
18	0.281		53.18	2232	2029	1827	1461	1218	1015	812	609	406
18	0.312		58.94	2479	2253	2028	1622	1352	1127	901	676	451
18	0.344		64.87	2733	2484	2236	1789	1491	1242	994	745	497
18	0.375	STD	70.59	2979	2708	2438	1950	1625	1354	1083	813	542
18	0.406		76.29	3225	2932	2639	2111	1759	1466	1173	880	586
18	0.438		82.15	3480	3163	2847	2278	1898	1582	1265	949	633
18	0.469		87.81	3726	3387	3049	2439	2032	1694	1355	1016	677
18	0.500	XS	93.45	3972	3611	3250	2600	2167	1806	1444	1083	722
18	0.562	40	104.66	4465	4059	3653	2922	2435	2029	1624	1218	812
18	0.625		115.98	4965	4514	4063	3250	2708	2257	1806	1354	903
18	0.688		127.20	5466	4969	4472	3578	2981	2484	1988	1491	994
18	0.750		138.17	5958	5417	4875	3900	3250	2708	2167	1625	1083
18	0.812		149.05	6451	5864	5278	4222	3519	2932	2346	1759	1173
18	0.938	80	170.92	7452	6774	6097	4878	4065	3387	2710	2032	1355
18	1.000		181.56	7944	7222	6500	5200	4333	3611	2889	2167	1444
20	0.250		52.73	1788	1625	1463	1170	975	813	650	488	325
20	0.278		58.55	1988	1807	1626	1301	1084	904	723	542	361
20	0.281		59.18	2009	1827	1644	1315	1096	913	731	548	365
20	0.312		65.60	2231	2028	1825	1460	1217	1014	811	608	406
20	0.334		70.15	2388	2171	1954	1563	1303	1086	868	651	434

EXHIBIT B
(60 of 72)

YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
20	0.344		72.21	2460	2236	2012	1610	1342	1118	894	671	447
20	0.347		72.83	2481	2256	2030	1624	1353	1128	902	677	451
20	0.375	STD	78.60	2681	2438	2194	1755	1463	1219	975	731	488
20	0.406		84.96	2903	2639	2375	1900	1583	1320	1056	792	528
20	0.417		87.21	2982	2711	2439	1952	1626	1355	1084	813	542
20	0.438		91.51	3132	2847	2562	2050	1708	1424	1139	854	569
20	0.462		96.40	3303	3003	2703	2162	1802	1502	1201	901	601
20	0.469		97.83	3353	3049	2744	2195	1829	1524	1219	915	610
20	0.500	XS	104.13	3575	3250	2925	2340	1950	1625	1300	975	650
20	0.562		116.67	4018	3653	3288	2630	2192	1827	1461	1096	731
20	0.594	40	123.11	4247	3861	3475	2780	2317	1931	1544	1158	772
20	0.625		129.33	4469	4063	3656	2925	2438	2031	1625	1219	813
20	0.688		141.90	4919	4472	4025	3220	2683	2236	1789	1342	894
20	0.750		154.19	5363	4875	4388	3510	2925	2438	1950	1463	975
20	0.812		166.40	5806	5278	4750	3800	3167	2639	2111	1583	1056
20	1.000		202.92	7150	6500	5850	4680	3900	3250	2600	1950	1300
22	0.250		58.07	1625	1477	1330	1064	886	739	591	443	295
22	0.281		65.18	1827	1660	1494	1196	996	830	664	498	332
22	0.312		72.27	2028	1844	1659	1327	1106	922	737	553	369
22	0.344		79.56	2236	2033	1829	1464	1220	1016	813	610	407
22	0.375	STD	86.61	2438	2216	1994	1595	1330	1108	886	665	443
22	0.438		100.86	2847	2588	2329	1863	1553	1294	1035	776	518
22	0.500	XS	114.81	3250	2955	2659	2127	1773	1477	1182	886	591
22	0.562		128.67	3653	3321	2989	2391	1993	1660	1328	996	664
22	0.625		142.68	4063	3693	3324	2659	2216	1847	1477	1108	739
22	0.688		156.59	4472	4065	3659	2927	2439	2033	1626	1220	813
22	0.750		170.21	4875	4432	3989	3191	2659	2216	1773	1330	886
22	0.812		183.74	5278	4798	4318	3455	2879	2399	1919	1439	960
24	0.250		63.41	1490	1354	1219	975	813	677	542	406	271
24	0.257		65.17	1531	1392	1253	1002	835	696	557	418	278
24	0.278		70.43	1656	1506	1355	1084	904	753	602	452	301
24	0.281		71.18	1674	1522	1370	1096	913	761	609	457	304
24	0.300		75.93	1788	1625	1463	1170	975	813	650	488	325
24	0.312		78.93	1859	1690	1521	1217	1014	845	676	507	338
24	0.334		84.42	1990	1809	1628	1303	1086	905	724	543	362
24	0.344		86.91	2050	1863	1677	1342	1118	932	745	559	373
24	0.370		93.37	2205	2004	1804	1443	1203	1002	802	601	401
24	0.375	STD	94.62	2234	2031	1828	1463	1219	1016	813	609	406
24	0.406		102.30	2419	2199	1979	1583	1320	1100	880	660	440
24	0.420		105.77	2503	2275	2048	1638	1365	1138	910	683	455
24	0.438		110.22	2610	2373	2135	1708	1424	1186	949	712	475
24	0.469		117.86	2794	2540	2286	1829	1524	1270	1016	762	508
24	0.500	XS	125.49	2979	2708	2438	1950	1625	1354	1083	813	542
24	0.562		140.68	3349	3044	2740	2192	1827	1522	1218	913	609
24	0.625		156.03	3724	3385	3047	2438	2031	1693	1354	1016	677
24	0.688	40	171.29	4099	3727	3354	2683	2236	1863	1491	1118	745
24	0.750		186.23	4469	4063	3656	2925	2438	2031	1625	1219	813
24	0.812		201.09	4838	4398	3959	3167	2639	2199	1759	1320	880
24	1.000		245.64	5958	5417	4875	3900	3250	2708	2167	1625	1083
26	0.250		68.75	1375	1250	1125	900	750	625	500	375	250
26	0.278		76.37	1529	1390	1251	1001	834	695	556	417	278
26	0.281		77.18	1546	1405	1265	1012	843	703	562	422	281
26	0.301		82.61	1656	1505	1355	1084	903	753	602	452	301
26	0.312		85.60	1716	1560	1404	1123	936	780	624	468	312
26	0.334		91.55	1837	1670	1503	1202	1002	835	668	501	334
26	0.344		94.26	1892	1720	1548	1238	1032	860	688	516	344
26	0.361		98.85	1986	1805	1625	1300	1083	903	722	542	361

EXHIBIT B
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YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
26	0.375	STD	102.63	2063	1875	1688	1350	1125	938	750	563	375
26	0.406		110.98	2233	2030	1827	1462	1218	1015	812	609	406
26	0.438		119.57	2409	2190	1971	1577	1314	1095	876	657	438
26	0.469		127.88	2580	2345	2111	1688	1407	1173	938	704	469
26	0.500	XS	136.17	2750	2500	2250	1800	1500	1250	1000	750	500
26	0.562		152.68	3091	2810	2529	2023	1686	1405	1124	843	562
26	0.625		169.38	3438	3125	2813	2250	1875	1563	1250	938	625
26	0.688		185.99	3784	3440	3096	2477	2064	1720	1376	1032	688
26	0.750		202.25	4125	3750	3375	2700	2250	1875	1500	1125	750
26	0.875		234.79	4813	4375	3938	3150	2625	2188	1750	1313	875
26	1.000		267.00	5500	5000	4500	3600	3000	2500	2000	1500	1000
28	0.250		74.09	1277	1161	1045	836	696	580	464	348	232
28	0.281		83.19	1435	1305	1174	939	783	652	522	391	261
28	0.312		92.26	1593	1449	1304	1043	869	724	579	435	290
28	0.344		101.60	1757	1597	1437	1150	958	799	639	479	319
28	0.375	STD	110.64	1915	1741	1567	1254	1045	871	696	522	348
28	0.406		119.65	2074	1885	1697	1357	1131	943	754	566	377
28	0.438		128.93	2237	2034	1830	1464	1220	1017	813	610	407
28	0.469		137.90	2395	2178	1960	1568	1307	1089	871	653	436
28	0.500	XS	146.85	2554	2321	2089	1671	1393	1161	929	696	464
28	0.562		164.68	2870	2609	2348	1879	1566	1305	1044	783	522
28	0.625		182.73	3192	2902	2612	2089	1741	1451	1161	871	580
30	0.281		89.19	1339	1218	1096	877	731	609	487	365	244
30	0.300		95.16	1430	1300	1170	936	780	650	520	390	260
30	0.312		98.92	1487	1352	1217	973	811	676	541	406	270
30	0.321		101.75	1530	1391	1252	1002	835	696	556	417	278
30	0.323		102.37	1540	1400	1260	1008	840	700	560	420	280
30	0.325		103.00	1549	1408	1268	1014	845	704	563	423	282
30	0.344		108.95	1640	1491	1342	1073	894	745	596	447	298
30	0.347		109.89	1654	1504	1353	1083	902	752	601	451	301
30	0.360		113.96	1716	1560	1404	1123	936	780	624	468	312
30	0.375	STD	118.65	1788	1625	1463	1170	975	813	650	488	325
30	0.385		121.77	1835	1668	1502	1201	1001	834	667	501	334
30	0.400		126.45	1907	1733	1560	1248	1040	867	693	520	347
30	0.406		128.32	1935	1759	1583	1267	1056	880	704	528	352
30	0.417		131.75	1988	1807	1626	1301	1084	904	723	542	361
30	0.420		132.68	2002	1820	1638	1310	1092	910	728	546	364
30	0.422		133.30	2012	1829	1646	1317	1097	914	731	549	366
30	0.438		138.28	2088	1898	1708	1367	1139	949	759	569	380
30	0.469		147.92	2236	2032	1829	1463	1219	1016	813	610	406
30	0.480		151.33	2288	2080	1872	1498	1248	1040	832	624	416
30	0.500	XS	157.53	2383	2167	1950	1560	1300	1083	867	650	433
30	0.504		158.77	2402	2184	1966	1572	1310	1092	874	655	437
30	0.525		165.26	2503	2275	2048	1638	1365	1138	910	683	455
30	0.530		166.81	2526	2297	2067	1654	1378	1148	919	689	459
30	0.562		176.69	2679	2435	2192	1753	1461	1218	974	731	487
30	0.563		177.00	2684	2440	2196	1757	1464	1220	976	732	488
30	0.625		196.08	2979	2708	2438	1950	1625	1354	1083	813	542
30	0.750		234.29	3575	3250	2925	2340	1950	1625	1300	975	650
30	0.875		272.17	4171	3792	3413	2730	2275	1896	1517	1138	758
30	1.000		309.72	4767	4333	3900	3120	2600	2167	1733	1300	867
30.2	0.423		134.52	2003	1821	1639	1311	1093	910	728	546	364
32	0.250		84.77	1117	1016	914	731	609	508	406	305	203
32	0.281		95.19	1256	1142	1027	822	685	571	457	342	228
32	0.312		105.59	1394	1268	1141	913	761	634	507	380	254
32	0.344		116.30	1537	1398	1258	1006	839	699	559	419	280

EXHIBIT B
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YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
32	0.375	STD	126.66	1676	1523	1371	1097	914	762	609	457	305
32	0.406		136.99	1814	1649	1484	1188	990	825	660	495	330
32	0.438		147.64	1957	1779	1601	1281	1068	890	712	534	356
32	0.469		157.93	2096	1905	1715	1372	1143	953	762	572	381
32	0.500	XS	168.21	2234	2031	1828	1463	1219	1016	813	609	406
32	0.562		188.69	2511	2283	2055	1644	1370	1142	913	685	457
32	0.625		209.43	2793	2539	2285	1828	1523	1270	1016	762	508
34	0.250		90.11	1051	956	860	688	574	478	382	287	191
34	0.281		101.19	1182	1074	967	774	645	537	430	322	215
34	0.312		112.25	1312	1193	1074	859	716	596	477	358	239
34	0.344		123.65	1447	1315	1184	947	789	658	526	395	263
34	0.375	STD	134.67	1577	1434	1290	1032	860	717	574	430	287
34	0.406		145.66	1708	1552	1397	1118	931	776	621	466	310
34	0.438		157.00	1842	1675	1507	1206	1005	837	670	502	335
34	0.469		167.95	1973	1793	1614	1291	1076	897	717	538	359
34	0.500	XS	178.89	2103	1912	1721	1376	1147	956	765	574	382
34	0.562		200.70	2364	2149	1934	1547	1289	1074	860	645	430
34	0.625		222.77	2629	2390	2151	1721	1434	1195	956	717	478
36	0.312		118.92	1239	1127	1014	811	676	563	451	338	225
36	0.344		131.00	1366	1242	1118	894	745	621	497	373	248
36	0.356		135.52	1414	1286	1157	926	771	643	514	386	257
36	0.375	STD	142.68	1490	1354	1219	975	813	677	542	406	271
36	0.385		146.44	1529	1390	1251	1001	834	695	556	417	278
36	0.388		147.57	1541	1401	1261	1009	841	701	560	420	280
36	0.406		154.34	1613	1466	1320	1056	880	733	586	440	293
36	0.417		158.47	1656	1506	1355	1084	904	753	602	452	301
36	0.438		166.35	1740	1582	1424	1139	949	791	633	475	316
36	0.450		170.85	1788	1625	1463	1170	975	813	650	488	325
36	0.469		177.97	1863	1694	1524	1219	1016	847	677	508	339
36	0.500	XS	189.57	1986	1806	1625	1300	1083	903	722	542	361
36	0.504		191.06	2002	1820	1638	1310	1092	910	728	546	364
36	0.525		198.91	2085	1896	1706	1365	1138	948	758	569	379
36	0.540		204.50	2145	1950	1755	1404	1170	975	780	585	390
36	0.562		212.70	2232	2029	1827	1461	1218	1015	812	609	406
36	0.600		226.84	2383	2167	1950	1560	1300	1083	867	650	433
36	0.605		228.70	2403	2185	1966	1573	1311	1092	874	655	437
36	0.625		236.12	2483	2257	2031	1625	1354	1128	903	677	451
36	0.660		249.10	2622	2383	2145	1716	1430	1192	953	715	477
36	0.688		259.46	2733	2484	2236	1789	1491	1242	994	745	497
36	0.750		282.35	2979	2708	2438	1950	1625	1354	1083	813	542
36	0.875		328.24	3476	3160	2844	2275	1896	1580	1264	948	632
36	1.000		373.79	3972	3611	3250	2600	2167	1806	1444	1083	722
36.24	0.508		193.86	2005	1822	1640	1312	1093	911	729	547	364
38	0.312		125.58	1174	1067	961	769	640	534	427	320	213
38	0.344		138.34	1295	1177	1059	847	706	588	471	353	235
38	0.375	STD	150.69	1411	1283	1155	924	770	641	513	385	257
38	0.406		163.01	1528	1389	1250	1000	833	694	556	417	278
38	0.438		175.71	1648	1498	1349	1079	899	749	599	450	300
38	0.469		187.99	1765	1604	1444	1155	963	802	642	481	321
38	0.500	XS	200.25	1882	1711	1539	1232	1026	855	684	513	342
38	0.562		224.71	2115	1923	1730	1384	1154	961	769	577	385
38	0.625		249.47	2352	2138	1924	1539	1283	1069	855	641	428
40	0.344		145.69	1230	1118	1006	805	671	559	447	335	224
40	0.375	STD	158.70	1341	1219	1097	878	731	609	488	366	244
40	0.406		171.68	1451	1320	1188	950	792	660	528	396	264

EXHIBIT B
(63 of 72)

YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
40	0.438		185.06	1566	1424	1281	1025	854	712	569	427	285
40	0.469		198.00	1677	1524	1372	1097	915	762	610	457	305
40	0.500	XS	210.93	1788	1625	1463	1170	975	813	650	488	325
40	0.562		236.71	2009	1827	1644	1315	1096	913	731	548	365
40	0.625		262.82	2234	2031	1828	1463	1219	1016	813	609	406
42	0.312		138.91	1062	966	869	695	579	483	386	290	193
42	0.323		143.77	1100	1000	900	720	600	500	400	300	200
42	0.344		153.04	1171	1065	958	767	639	532	426	319	213
42	0.363		161.42	1236	1124	1011	809	674	562	449	337	225
42	0.375	STD	166.71	1277	1161	1045	836	696	580	464	348	232
42	0.406		180.35	1382	1257	1131	905	754	628	503	377	251
42	0.417		185.19	1420	1291	1162	929	774	645	516	387	258
42	0.438		194.42	1491	1356	1220	976	813	678	542	407	271
42	0.450		199.69	1532	1393	1254	1003	836	696	557	418	279
42	0.469		208.02	1597	1452	1307	1045	871	726	581	436	290
42	0.486		215.47	1655	1504	1354	1083	903	752	602	451	301
42	0.500	XS	221.61	1702	1548	1393	1114	929	774	619	464	310
42	0.562		248.71	1913	1740	1566	1252	1044	870	696	522	348
42	0.625		276.17	2128	1935	1741	1393	1161	967	774	580	387
42	0.688		303.55	2342	2130	1917	1533	1278	1065	852	639	426
42	0.750		330.41	2554	2321	2089	1671	1393	1161	929	696	464
42	0.812		357.18	2765	2513	2262	1810	1508	1257	1005	754	503
42	0.875		384.31	2979	2708	2438	1950	1625	1354	1083	813	542
42	1.000		437.87	3405	3095	2786	2229	1857	1548	1238	929	619
44	0.312		145.57	1014	922	830	664	553	461	369	277	184
44	0.334		155.76	1086	987	888	711	592	493	395	296	197
44	0.344		160.39	1118	1016	915	732	610	508	407	305	203
44	0.370		172.41	1203	1093	984	787	656	547	437	328	219
44	0.375	STD	174.72	1219	1108	997	798	665	554	443	332	222
44	0.406		189.02	1320	1200	1080	864	720	600	480	360	240
44	0.417		194.10	1355	1232	1109	887	739	616	493	370	246
44	0.438		203.77	1424	1294	1165	932	776	647	518	388	259
44	0.469		218.04	1524	1386	1247	998	831	693	554	416	277
44	0.476		221.26	1547	1406	1266	1013	844	703	563	422	281
44	0.500	XS	232.29	1625	1477	1330	1064	886	739	591	443	295
44	0.513		238.25	1667	1516	1364	1091	909	758	606	455	303
44	0.556		257.97	1807	1643	1478	1183	986	821	657	493	329
44	0.562		260.72	1827	1660	1494	1196	996	830	664	498	332
44	0.625		289.52	2031	1847	1662	1330	1108	923	739	554	369
44	0.688		318.25	2236	2033	1829	1464	1220	1016	813	610	407
44	0.750		346.43	2438	2216	1994	1595	1330	1108	886	665	443
44	0.812		374.53	2639	2399	2159	1727	1439	1200	960	720	480
44	0.875		403.00	2844	2585	2327	1861	1551	1293	1034	776	517
44	1.000		459.23	3250	2955	2659	2127	1773	1477	1182	886	591
46	0.312		152.24	970	882	794	635	529	441	353	265	176
46	0.334		162.89	1038	944	850	680	566	472	378	283	189
46	0.344		167.73	1069	972	875	700	583	486	389	292	194
46	0.370		180.31	1150	1046	941	753	627	523	418	314	209
46	0.375	STD	182.73	1166	1060	954	763	636	530	424	318	212
46	0.406		197.70	1262	1147	1033	826	688	574	459	344	229
46	0.417		203.00	1296	1178	1061	849	707	589	471	354	236
46	0.438		213.13	1362	1238	1114	891	743	619	495	371	248
46	0.469		228.06	1458	1325	1193	954	795	663	530	398	265
46	0.476		231.43	1480	1345	1211	969	807	673	538	404	269
46	0.500	XS	242.97	1554	1413	1272	1017	848	707	565	424	283
46	0.513		249.21	1595	1450	1305	1044	870	725	580	435	290
46	0.556		269.85	1728	1571	1414	1131	943	786	629	471	314

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Steel Pipe Design**	Standard Number: **GS 2110.020**
Supersedes: 05/01/2008		Page 79 of 87

EXHIBIT B
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YIELD 65,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
46	0.562		272.72	1747	1588	1429	1144	953	794	635	476	318
46	0.625		302.87	1943	1766	1590	1272	1060	883	707	530	353
46	0.688		332.94	2139	1944	1750	1400	1167	972	778	583	389
46	0.750		362.45	2332	2120	1908	1526	1272	1060	848	636	424
46	0.812		391.87	2524	2295	2065	1652	1377	1147	918	688	459
46	0.875		421.69	2720	2473	2226	1780	1484	1236	989	742	495
46	1.000		480.59	3109	2826	2543	2035	1696	1413	1130	848	565
48	0.312		158.90	930	845	761	608	507	423	338	254	169
48	0.334		170.03	995	905	814	651	543	452	362	271	181
48	0.344		175.08	1025	932	839	671	559	466	373	280	186
48	0.370		188.21	1102	1002	902	722	601	501	401	301	200
48	0.375	STD	190.74	1117	1016	914	731	609	508	406	305	203
48	0.406		206.37	1210	1100	990	792	660	550	440	330	220
48	0.417		211.91	1242	1129	1016	813	678	565	452	339	226
48	0.438		222.48	1305	1186	1068	854	712	593	475	356	237
48	0.469		238.08	1397	1270	1143	915	762	635	508	381	254
48	0.476		241.59	1418	1289	1160	928	774	645	516	387	258
48	0.500	XS	253.65	1490	1354	1219	975	813	677	542	406	271
48	0.513		260.17	1528	1389	1250	1000	834	695	556	417	278
48	0.556		281.72	1656	1506	1355	1084	904	753	602	452	301
48	0.562		284.73	1674	1522	1370	1096	913	761	609	457	304
48	0.625		316.22	1862	1693	1523	1219	1016	846	677	508	339
48	0.688		347.64	2050	1863	1677	1342	1118	932	745	559	373
48	0.750		378.47	2234	2031	1828	1463	1219	1016	813	609	406
48	0.812		409.22	2419	2199	1979	1583	1320	1100	880	660	440
48	0.875		440.38	2607	2370	2133	1706	1422	1185	948	711	474
48	1.000		501.95	2979	2708	2438	1950	1625	1354	1083	813	542

EXHIBIT B
(65 of 72)

YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
2	0.154	STD - 40	3.65	9986	9078	8170	6536	5447	4539	3631	2723	1816
2	0.218	XS - 80	5.02	14136	12851	11565	9252	7710	6425	5140	3855	2570
2	0.250		5.67	16211	14737	13263	10611	8842	7368	5895	4421	2947
2	0.344	160	7.46	22306	20278	18250	14600	12167	10139	8111	6083	4056
2	0.436	XXS	9.03	28271	25701	23131	18505	15421	12851	10280	7710	5140
3	0.125		4.51	5500	5000	4500	3600	3000	2500	2000	1500	1000
3	0.156		5.57	6864	6240	5616	4493	3744	3120	2496	1872	1248
3	0.188		6.65	8272	7520	6768	5414	4512	3760	3008	2256	1504
3	0.216	STD - 40	7.58	9504	8640	7776	6221	5184	4320	3456	2592	1728
3	0.250		8.68	11000	10000	9000	7200	6000	5000	4000	3000	2000
3	0.281		9.66	12364	11240	10116	8093	6744	5620	4496	3372	2248
3	0.300	XS - 80	10.25	13200	12000	10800	8640	7200	6000	4800	3600	2400
3	0.438	160	14.32	19272	17520	15768	12614	10512	8760	7008	5256	3504
3	0.600	XXS	18.58	26400	24000	21600	17280	14400	12000	9600	7200	4800
4	0.125		5.84	4278	3889	3500	2800	2333	1944	1556	1167	778
4	0.141		6.56	4825	4387	3948	3158	2632	2193	1755	1316	877
4	0.156		7.24	5339	4853	4368	3494	2912	2427	1941	1456	971
4	0.172		7.95	5886	5351	4816	3853	3211	2676	2140	1605	1070
4	0.188		8.66	6434	5849	5264	4211	3509	2924	2340	1755	1170
4	0.203		9.32	6947	6316	5684	4547	3789	3158	2526	1895	1263
4	0.219		10.01	7495	6813	6132	4906	4088	3407	2725	2044	1363
4	0.237	STD - 40	10.79	8111	7373	6636	5309	4424	3687	2949	2212	1475
4	0.250		11.35	8556	7778	7000	5600	4667	3889	3111	2333	1556
4	0.281		12.66	9616	8742	7868	6294	5245	4371	3497	2623	1748
4	0.312		13.95	10677	9707	8736	6989	5824	4853	3883	2912	1941
4	0.337	XS - 80	14.98	11533	10484	9436	7549	6291	5242	4194	3145	2097
4	0.438	120	19.00	14989	13627	12264	9811	8176	6813	5451	4088	2725
4	0.500		21.36	17111	15556	14000	11200	9333	7778	6222	4667	3111
4	0.531	160	22.51	18172	16520	14868	11894	9912	8260	6608	4956	3304
4	0.674	XXS	27.54	23066	20969	18872	15098	12581	10484	8388	6291	4194
5	0.156		9.01	4319	3926	3533	2827	2356	1963	1570	1178	785
5	0.188		10.79	5204	4731	4258	3407	2839	2366	1893	1419	946
5	0.219		12.50	6063	5511	4960	3968	3307	2756	2205	1653	1102
5	0.258	STD - 40	14.62	7142	6493	5844	4675	3896	3246	2597	1948	1299
5	0.281		15.85	7779	7072	6365	5092	4243	3536	2829	2122	1414
5	0.312		17.50	8637	7852	7067	5653	4711	3926	3141	2356	1570
5	0.344		19.17	9523	8657	7791	6233	5194	4329	3463	2597	1731
5	0.375	XS - 80	20.78	10381	9437	8494	6795	5662	4719	3775	2831	1887
5	0.500	120	27.04	13841	12583	11325	9060	7550	6292	5033	3775	2517
5	0.625	160	32.96	17302	15729	14156	11325	9437	7864	6292	4719	3146
5	0.750	XXS	38.55	20762	18875	16987	13590	11325	9437	7550	5662	3775
6	0.156		10.78	3626	3297	2967	2374	1978	1648	1319	989	659
6	0.172		11.85	3998	3635	3271	2617	2181	1817	1454	1090	727
6	0.188		12.92	4370	3973	3576	2860	2384	1986	1589	1192	795
6	0.203		13.92	4719	4290	3861	3089	2574	2145	1716	1287	858
6	0.219		14.98	5091	4628	4165	3332	2777	2314	1851	1388	926
6	0.250		17.02	5811	5283	4755	3804	3170	2642	2113	1585	1057
6	0.277		18.78	6439	5854	5268	4215	3512	2927	2341	1756	1171
6	0.280	STD - 40	18.97	6509	5917	5325	4260	3550	2958	2367	1775	1183
6	0.312		21.04	7253	6593	5934	4747	3956	3297	2637	1978	1319
6	0.344		23.08	7996	7269	6542	5234	4362	3635	2908	2181	1454
6	0.375		25.03	8717	7925	7132	5706	4755	3962	3170	2377	1585
6	0.432	XS - 80	28.57	10042	9129	8216	6573	5477	4565	3652	2739	1826
6	0.500		32.71	11623	10566	9509	7608	6340	5283	4226	3170	2113
6	0.562	120	36.39	13064	11876	10689	8551	7126	5938	4750	3563	2375
6	0.625		40.05	14528	13208	11887	9509	7925	6604	5283	3962	2642

EXHIBIT B
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YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
6	0.719	160	45.35	16713	15194	13675	10940	9116	7597	6078	4558	3039
6	0.864	XXS	53.16	20084	18258	16432	13146	10955	9129	7303	5477	3652
8	0.172		15.53	3071	2792	2513	2010	1675	1396	1117	838	558
8	0.188		16.94	3357	3052	2746	2197	1831	1526	1221	915	610
8	0.203		18.26	3625	3295	2966	2372	1977	1648	1318	989	659
8	0.219		19.66	3910	3555	3199	2559	2133	1777	1422	1066	711
8	0.250		22.36	4464	4058	3652	2922	2435	2029	1623	1217	812
8	0.277		24.70	4946	4496	4047	3237	2698	2248	1798	1349	899
8	0.312		27.70	5571	5064	4558	3646	3039	2532	2026	1519	1013
8	0.322	STD - 40	28.55	5749	5227	4704	3763	3136	2613	2091	1568	1045
8	0.344		30.42	6142	5584	5025	4020	3350	2792	2234	1675	1117
8	0.375		33.04	6696	6087	5478	4383	3652	3043	2435	1826	1217
8	0.406		35.64	7249	6590	5931	4745	3954	3295	2636	1977	1318
8	0.438		38.30	7821	7110	6399	5119	4266	3555	2844	2133	1422
8	0.500	XS - 80	43.39	8928	8116	7304	5843	4870	4058	3246	2435	1623
8	0.562		48.39	10035	9122	8210	6568	5473	4561	3649	2737	1824
8	0.594		50.95	10606	9642	8678	6942	5785	4821	3857	2893	1928
8	0.625		53.40	11159	10145	9130	7304	6087	5072	4058	3043	2029
8	0.719	120	60.71	12838	11671	10504	8403	7002	5835	4668	3501	2334
8	0.812		67.75	14498	13180	11862	9490	7908	6590	5272	3954	2636
8	0.875	XXS	72.42	15623	14203	12783	10226	8522	7101	5681	4261	2841
8	0.906	160	74.69	16177	14706	13235	10588	8824	7353	5882	4412	2941
10	0.188		21.21	2693	2448	2204	1763	1469	1224	979	735	490
10	0.203		22.87	2908	2644	2379	1903	1586	1322	1057	793	529
10	0.219		24.63	3137	2852	2567	2054	1711	1426	1141	856	570
10	0.250		28.03	3581	3256	2930	2344	1953	1628	1302	977	651
10	0.279		31.20	3997	3633	3270	2616	2180	1817	1453	1090	727
10	0.307		34.24	4398	3998	3598	2879	2399	1999	1599	1199	800
10	0.344		38.23	4928	4480	4032	3226	2688	2240	1792	1344	896
10	0.365	STD - 40	40.48	5229	4753	4278	3423	2852	2377	1901	1426	951
10	0.438		48.24	6275	5704	5134	4107	3423	2852	2282	1711	1141
10	0.500	XS	54.73	7163	6512	5860	4688	3907	3256	2605	1953	1302
10	0.562		61.15	8051	7319	6587	5270	4391	3660	2928	2196	1464
10	0.594	80	64.43	8509	7736	6962	5570	4641	3868	3094	2321	1547
10	0.625		67.58	8953	8140	7326	5860	4884	4070	3256	2442	1628
10	0.719		77.03	10300	9364	8427	6742	5618	4682	3745	2809	1873
10	0.750		80.10	10744	9767	8791	7033	5860	4884	3907	2930	1953
10	0.812		86.18	11632	10575	9517	7614	6345	5287	4230	3172	2115
10	0.844	120	89.29	12091	10992	9892	7914	6595	5496	4397	3297	2198
10	0.875		92.28	12535	11395	10256	8205	6837	5698	4558	3419	2279
10	1.000	XXS	104.13	14326	13023	11721	9377	7814	6512	5209	3907	2605
12	0.203		27.20	2452	2229	2006	1605	1337	1115	892	669	446
12	0.219		29.31	2645	2405	2164	1731	1443	1202	962	721	481
12	0.250		33.37	3020	2745	2471	1976	1647	1373	1098	824	549
12	0.281		37.42	3394	3085	2777	2222	1851	1543	1234	926	617
12	0.312		41.44	3768	3426	3083	2467	2056	1713	1370	1028	685
12	0.330		43.77	3986	3624	3261	2609	2174	1812	1449	1087	725
12	0.344		45.58	4155	3777	3400	2720	2266	1889	1511	1133	755
12	0.375	STD	49.56	4529	4118	3706	2965	2471	2059	1647	1235	824
12	0.406	40	53.52	4904	4458	4012	3210	2675	2229	1783	1337	892
12	0.438		57.59	5290	4809	4328	3463	2886	2405	1924	1443	962
12	0.500	XS	65.41	6039	5490	4941	3953	3294	2745	2196	1647	1098
12	0.562		73.15	6788	6171	5554	4443	3703	3085	2468	1851	1234
12	0.625		80.93	7549	6863	6176	4941	4118	3431	2745	2059	1373
12	0.688	80	88.63	8310	7555	6799	5439	4533	3777	3022	2266	1511
12	0.750		96.12	9059	8235	7412	5929	4941	4118	3294	2471	1647
12	0.844		107.32	10194	9267	8341	6673	5560	4634	3707	2780	1853

EXHIBIT B
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YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
12	0.875		110.97	10569	9608	8647	6918	5765	4804	3843	2882	1922
12	1.000	XXS - 120	125.49	12078	10980	9882	7906	6588	5490	4392	3294	2196
14	0.210		30.93	2310	2100	1890	1512	1260	1050	840	630	420
14	0.219		32.23	2409	2190	1971	1577	1314	1095	876	657	438
14	0.250		36.71	2750	2500	2250	1800	1500	1250	1000	750	500
14	0.281		41.17	3091	2810	2529	2023	1686	1405	1124	843	562
14	0.312		45.61	3432	3120	2808	2246	1872	1560	1248	936	624
14	0.344		50.17	3784	3440	3096	2477	2064	1720	1376	1032	688
14	0.375	STD	54.57	4125	3750	3375	2700	2250	1875	1500	1125	750
14	0.438	40	63.44	4818	4380	3942	3154	2628	2190	1752	1314	876
14	0.469		67.77	5159	4690	4221	3377	2814	2345	1876	1407	938
14	0.500	XS	72.09	5500	5000	4500	3600	3000	2500	2000	1500	1000
14	0.562		80.66	6182	5620	5058	4046	3372	2810	2248	1686	1124
14	0.594		85.05	6534	5940	5346	4277	3564	2970	2376	1782	1188
14	0.625		89.28	6875	6250	5625	4500	3750	3125	2500	1875	1250
14	0.688		97.81	7568	6880	6192	4954	4128	3440	2752	2064	1376
14	0.750	80	106.13	8250	7500	6750	5400	4500	3750	3000	2250	1500
14	0.812		114.37	8932	8120	7308	5846	4872	4060	3248	2436	1624
16	0.219		36.91	2108	1916	1725	1380	1150	958	767	575	383
16	0.250		42.05	2406	2188	1969	1575	1313	1094	875	656	438
16	0.281		47.17	2705	2459	2213	1770	1475	1229	984	738	492
16	0.312		52.27	3003	2730	2457	1966	1638	1365	1092	819	546
16	0.344		57.52	3311	3010	2709	2167	1806	1505	1204	903	602
16	0.375	STD	62.58	3609	3281	2953	2363	1969	1641	1313	984	656
16	0.438		72.80	4216	3833	3449	2759	2300	1916	1533	1150	767
16	0.469		77.79	4514	4104	3693	2955	2462	2052	1642	1231	821
16	0.500	XXS - 40	82.77	4813	4375	3938	3150	2625	2188	1750	1313	875
16	0.562		92.66	5409	4918	4426	3541	2951	2459	1967	1475	984
16	0.625		102.63	6016	5469	4922	3938	3281	2734	2188	1641	1094
16	0.656		107.50	6314	5740	5166	4133	3444	2870	2296	1722	1148
16	0.688		112.51	6622	6020	5418	4334	3612	3010	2408	1806	1204
16	0.750		122.15	7219	6563	5906	4725	3938	3281	2625	1969	1313
16	0.812		131.71	7816	7105	6395	5116	4263	3553	2842	2132	1421
16	0.844	80	136.61	8124	7385	6647	5317	4431	3693	2954	2216	1477
16	1.000		160.20	9625	8750	7875	6300	5250	4375	3500	2625	1750
18	0.250		47.39	2139	1944	1750	1400	1167	972	778	583	389
18	0.281		53.18	2404	2186	1967	1574	1311	1093	874	656	437
18	0.312		58.94	2669	2427	2184	1747	1456	1213	971	728	485
18	0.344		64.87	2943	2676	2408	1926	1605	1338	1070	803	535
18	0.375	STD	70.59	3208	2917	2625	2100	1750	1458	1167	875	583
18	0.406		76.29	3474	3158	2842	2274	1895	1579	1263	947	632
18	0.438		82.15	3747	3407	3066	2453	2044	1703	1363	1022	681
18	0.469		87.81	4013	3648	3283	2626	2189	1824	1459	1094	730
18	0.500	XS	93.45	4278	3889	3500	2800	2333	1944	1556	1167	778
18	0.562	40	104.66	4808	4371	3934	3147	2623	2186	1748	1311	874
18	0.625		115.98	5347	4861	4375	3500	2917	2431	1944	1458	972
18	0.688		127.20	5886	5351	4816	3853	3211	2676	2140	1605	1070
18	0.750		138.17	6417	5833	5250	4200	3500	2917	2333	1750	1167
18	0.812		149.05	6947	6316	5684	4547	3789	3158	2526	1895	1263
18	0.938	80	170.92	8025	7296	6566	5253	4377	3648	2918	2189	1459
18	1.000		181.56	8556	7778	7000	5600	4667	3889	3111	2333	1556
20	0.250		52.73	1925	1750	1575	1260	1050	875	700	525	350
20	0.278		58.55	2141	1946	1751	1401	1168	973	778	584	389
20	0.281		59.18	2164	1967	1770	1416	1180	984	787	590	393
20	0.312		65.60	2402	2184	1966	1572	1310	1092	874	655	437
20	0.334		70.15	2572	2338	2104	1683	1403	1169	935	701	468

EXHIBIT B
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YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
20	0.344		72.21	2649	2408	2167	1734	1445	1204	963	722	482
20	0.347		72.83	2672	2429	2186	1749	1457	1215	972	729	486
20	0.375	STD	78.60	2888	2625	2363	1890	1575	1313	1050	788	525
20	0.406		84.96	3126	2842	2558	2046	1705	1421	1137	853	568
20	0.417		87.21	3211	2919	2627	2102	1751	1460	1168	876	584
20	0.438		91.51	3373	3066	2759	2208	1840	1533	1226	920	613
20	0.462		96.40	3557	3234	2911	2328	1940	1617	1294	970	647
20	0.469		97.83	3611	3283	2955	2364	1970	1642	1313	985	657
20	0.500	XS	104.13	3850	3500	3150	2520	2100	1750	1400	1050	700
20	0.562		116.67	4327	3934	3541	2832	2360	1967	1574	1180	787
20	0.594	40	123.11	4574	4158	3742	2994	2495	2079	1663	1247	832
20	0.625		129.33	4813	4375	3938	3150	2625	2188	1750	1313	875
20	0.688		141.90	5298	4816	4334	3468	2890	2408	1926	1445	963
20	0.750		154.19	5775	5250	4725	3780	3150	2625	2100	1575	1050
20	0.812		166.40	6252	5684	5116	4092	3410	2842	2274	1705	1137
20	1.000		202.92	7700	7000	6300	5040	4200	3500	2800	2100	1400
22	0.250		58.07	1750	1591	1432	1145	955	795	636	477	318
22	0.281		65.18	1967	1788	1609	1287	1073	894	715	536	358
22	0.312		72.27	2184	1985	1787	1430	1191	993	794	596	397
22	0.344		79.56	2408	2189	1970	1576	1313	1095	876	657	438
22	0.375	STD	86.61	2625	2386	2148	1718	1432	1193	955	716	477
22	0.438		100.86	3066	2787	2509	2007	1672	1394	1115	836	557
22	0.500	XS	114.81	3500	3182	2864	2291	1909	1591	1273	955	636
22	0.562		128.67	3934	3576	3219	2575	2146	1788	1431	1073	715
22	0.625		142.68	4375	3977	3580	2864	2386	1989	1591	1193	795
22	0.688		156.59	4816	4378	3940	3152	2627	2189	1751	1313	876
22	0.750		170.21	5250	4773	4295	3436	2864	2386	1909	1432	955
22	0.812		183.74	5684	5167	4651	3720	3100	2584	2067	1550	1033
24	0.250		63.41	1604	1458	1313	1050	875	729	583	438	292
24	0.257		65.17	1649	1499	1349	1079	900	750	600	450	300
24	0.278		70.43	1784	1622	1460	1168	973	811	649	487	324
24	0.281		71.18	1803	1639	1475	1180	984	820	656	492	328
24	0.300		75.93	1925	1750	1575	1260	1050	875	700	525	350
24	0.312		78.93	2002	1820	1638	1310	1092	910	728	546	364
24	0.334		84.42	2143	1948	1754	1403	1169	974	779	585	390
24	0.344		86.91	2207	2007	1806	1445	1204	1003	803	602	401
24	0.370		93.37	2374	2158	1943	1554	1295	1079	863	648	432
24	0.375	STD	94.62	2406	2188	1969	1575	1313	1094	875	656	438
24	0.406		102.30	2605	2368	2132	1705	1421	1184	947	711	474
24	0.420		105.77	2695	2450	2205	1764	1470	1225	980	735	490
24	0.438		110.22	2811	2555	2300	1840	1533	1278	1022	767	511
24	0.469		117.86	3009	2736	2462	1970	1642	1368	1094	821	547
24	0.500	XS	125.49	3208	2917	2625	2100	1750	1458	1167	875	583
24	0.562		140.68	3606	3278	2951	2360	1967	1639	1311	984	656
24	0.625		156.03	4010	3646	3281	2625	2188	1823	1458	1094	729
24	0.688	40	171.29	4415	4013	3612	2890	2408	2007	1605	1204	803
24	0.750		186.23	4813	4375	3938	3150	2625	2188	1750	1313	875
24	0.812		201.09	5210	4737	4263	3410	2842	2368	1895	1421	947
24	1.000		245.64	6417	5833	5250	4200	3500	2917	2333	1750	1167
26	0.250		68.75	1481	1346	1212	969	808	673	538	404	269
26	0.278		76.37	1647	1497	1347	1078	898	748	599	449	299
26	0.281		77.18	1664	1513	1362	1089	908	757	605	454	303
26	0.301		82.61	1783	1621	1459	1167	972	810	648	486	324
26	0.312		85.60	1848	1680	1512	1210	1008	840	672	504	336
26	0.334		91.55	1978	1798	1619	1295	1079	899	719	540	360
26	0.344		94.26	2038	1852	1667	1334	1111	926	741	556	370
26	0.361		98.85	2138	1944	1749	1400	1166	972	778	583	389

EXHIBIT B
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YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

PRESSURE (PSIG)

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
26	0.375	STD	102.63	2221	2019	1817	1454	1212	1010	808	606	404
26	0.406		110.98	2405	2186	1968	1574	1312	1093	874	656	437
26	0.438		119.57	2594	2358	2123	1698	1415	1179	943	708	472
26	0.469		127.88	2778	2525	2273	1818	1515	1263	1010	758	505
26	0.500	XS	136.17	2962	2692	2423	1938	1615	1346	1077	808	538
26	0.562		152.68	3329	3026	2724	2179	1816	1513	1210	908	605
26	0.625		169.38	3702	3365	3029	2423	2019	1683	1346	1010	673
26	0.688		185.99	4075	3705	3334	2667	2223	1852	1482	1111	741
26	0.750		202.25	4442	4038	3635	2908	2423	2019	1615	1212	808
26	0.875		234.79	5183	4712	4240	3392	2827	2356	1885	1413	942
26	1.000		267.00	5923	5385	4846	3877	3231	2692	2154	1615	1077
28	0.250		74.09	1375	1250	1125	900	750	625	500	375	250
28	0.281		83.19	1546	1405	1265	1012	843	703	562	422	281
28	0.312		92.26	1716	1560	1404	1123	936	780	624	468	312
28	0.344		101.60	1892	1720	1548	1238	1032	860	688	516	344
28	0.375	STD	110.64	2063	1875	1688	1350	1125	938	750	563	375
28	0.406		119.65	2233	2030	1827	1462	1218	1015	812	609	406
28	0.438		128.93	2409	2190	1971	1577	1314	1095	876	657	438
28	0.469		137.90	2580	2345	2111	1688	1407	1173	938	704	469
28	0.500	XS	146.85	2750	2500	2250	1800	1500	1250	1000	750	500
28	0.562		164.68	3091	2810	2529	2023	1686	1405	1124	843	562
28	0.625		182.73	3438	3125	2813	2250	1875	1563	1250	938	625
30	0.281		89.19	1442	1311	1180	944	787	656	525	393	262
30	0.300		95.16	1540	1400	1260	1008	840	700	560	420	280
30	0.312		98.92	1602	1456	1310	1048	874	728	582	437	291
30	0.321		101.75	1648	1498	1348	1079	899	749	599	449	300
30	0.323		102.37	1658	1507	1357	1085	904	754	603	452	301
30	0.325		103.00	1668	1517	1365	1092	910	758	607	455	303
30	0.344		108.95	1766	1605	1445	1156	963	803	642	482	321
30	0.347		109.89	1781	1619	1457	1166	972	810	648	486	324
30	0.360		113.96	1848	1680	1512	1210	1008	840	672	504	336
30	0.375	STD	118.65	1925	1750	1575	1260	1050	875	700	525	350
30	0.385		121.77	1976	1797	1617	1294	1078	898	719	539	359
30	0.400		126.45	2053	1867	1680	1344	1120	933	747	560	373
30	0.406		128.32	2084	1895	1705	1364	1137	947	758	568	379
30	0.417		131.75	2141	1946	1751	1401	1168	973	778	584	389
30	0.420		132.68	2156	1960	1764	1411	1176	980	784	588	392
30	0.422		133.30	2166	1969	1772	1418	1182	985	788	591	394
30	0.438		138.28	2248	2044	1840	1472	1226	1022	818	613	409
30	0.469		147.92	2408	2189	1970	1576	1313	1094	875	657	438
30	0.480		151.33	2464	2240	2016	1613	1344	1120	896	672	448
30	0.500	XS	157.53	2567	2333	2100	1680	1400	1167	933	700	467
30	0.504		158.77	2587	2352	2117	1693	1411	1176	941	706	470
30	0.525		165.26	2695	2450	2205	1764	1470	1225	980	735	490
30	0.530		166.81	2721	2473	2226	1781	1484	1237	989	742	495
30	0.562		176.69	2885	2623	2360	1888	1574	1311	1049	787	525
30	0.563		177.00	2890	2627	2365	1892	1576	1314	1051	788	525
30	0.625		196.08	3208	2917	2625	2100	1750	1458	1167	875	583
30	0.750		234.29	3850	3500	3150	2520	2100	1750	1400	1050	700
30	0.875		272.17	4492	4083	3675	2940	2450	2042	1633	1225	817
30	1.000		309.72	5133	4667	4200	3360	2800	2333	1867	1400	933
30.2	0.423		134.52	2157	1961	1765	1412	1177	980	784	588	392
32	0.250		84.77	1203	1094	984	788	656	547	438	328	219
32	0.281		95.19	1352	1229	1106	885	738	615	492	369	246
32	0.312		105.59	1502	1365	1229	983	819	683	546	410	273
32	0.344		116.30	1656	1505	1355	1084	903	753	602	452	301

EXHIBIT B
(70 of 72)

YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
32	0.375	STD	126.66	1805	1641	1477	1181	984	820	656	492	328
32	0.406		136.99	1954	1776	1599	1279	1066	888	711	533	355
32	0.438		147.64	2108	1916	1725	1380	1150	958	767	575	383
32	0.469		157.93	2257	2052	1847	1477	1231	1026	821	616	410
32	0.500	XS	168.21	2406	2188	1969	1575	1313	1094	875	656	438
32	0.562		188.69	2705	2459	2213	1770	1475	1229	984	738	492
32	0.625		209.43	3008	2734	2461	1969	1641	1367	1094	820	547
34	0.250		90.11	1132	1029	926	741	618	515	412	309	206
34	0.281		101.19	1273	1157	1041	833	694	579	463	347	231
34	0.312		112.25	1413	1285	1156	925	771	642	514	385	257
34	0.344		123.65	1558	1416	1275	1020	850	708	567	425	283
34	0.375	STD	134.67	1699	1544	1390	1112	926	772	618	463	309
34	0.406		145.66	1839	1672	1505	1204	1003	836	669	502	334
34	0.438		157.00	1984	1804	1623	1299	1082	902	721	541	361
34	0.469		167.95	2124	1931	1738	1390	1159	966	772	579	386
34	0.500	XS	178.89	2265	2059	1853	1482	1235	1029	824	618	412
34	0.562		200.70	2546	2314	2083	1666	1388	1157	926	694	463
34	0.625		222.77	2831	2574	2316	1853	1544	1287	1029	772	515
36	0.312		118.92	1335	1213	1092	874	728	607	485	364	243
36	0.344		131.00	1472	1338	1204	963	803	669	535	401	268
36	0.356		135.52	1523	1384	1246	997	831	692	554	415	277
36	0.375	STD	142.68	1604	1458	1313	1050	875	729	583	438	292
36	0.385		146.44	1647	1497	1348	1078	898	749	599	449	299
36	0.388		147.57	1660	1509	1358	1086	905	754	604	453	302
36	0.406		154.34	1737	1579	1421	1137	947	789	632	474	316
36	0.417		158.47	1784	1622	1460	1168	973	811	649	487	324
36	0.438		166.35	1874	1703	1533	1226	1022	852	681	511	341
36	0.450		170.85	1925	1750	1575	1260	1050	875	700	525	350
36	0.469		177.97	2006	1824	1642	1313	1094	912	730	547	365
36	0.500	XS	189.57	2139	1944	1750	1400	1167	972	778	583	389
36	0.504		191.06	2156	1960	1764	1411	1176	980	784	588	392
36	0.525		198.91	2246	2042	1838	1470	1225	1021	817	613	408
36	0.540		204.50	2310	2100	1890	1512	1260	1050	840	630	420
36	0.562		212.70	2404	2186	1967	1574	1311	1093	874	656	437
36	0.600		226.84	2567	2333	2100	1680	1400	1167	933	700	467
36	0.605		228.70	2588	2353	2118	1694	1412	1176	941	706	471
36	0.625		236.12	2674	2431	2188	1750	1458	1215	972	729	486
36	0.660		249.10	2823	2567	2310	1848	1540	1283	1027	770	513
36	0.688		259.46	2943	2676	2408	1926	1605	1338	1070	803	535
36	0.750		282.35	3208	2917	2625	2100	1750	1458	1167	875	583
36	0.875		328.24	3743	3403	3063	2450	2042	1701	1361	1021	681
36	1.000		373.79	4278	3889	3500	2800	2333	1944	1556	1167	778
36.24	0.508		193.86	2159	1962	1766	1413	1177	981	785	589	392
38	0.312		125.58	1264	1149	1035	828	690	575	460	345	230
38	0.344		138.34	1394	1267	1141	913	760	634	507	380	253
38	0.375	STD	150.69	1520	1382	1243	995	829	691	553	414	276
38	0.406		163.01	1645	1496	1346	1077	897	748	598	449	299
38	0.438		175.71	1775	1614	1452	1162	968	807	645	484	323
38	0.469		187.99	1901	1728	1555	1244	1037	864	691	518	346
38	0.500	XS	200.25	2026	1842	1658	1326	1105	921	737	553	368
38	0.562		224.71	2278	2071	1863	1491	1242	1035	828	621	414
38	0.625		249.47	2533	2303	2072	1658	1382	1151	921	691	461
40	0.344		145.69	1324	1204	1084	867	722	602	482	361	241
40	0.375	STD	158.70	1444	1313	1181	945	788	656	525	394	263
40	0.406		171.68	1563	1421	1279	1023	853	711	568	426	284

EXHIBIT B
(71 of 72)

YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
40	0.438		185.06	1686	1533	1380	1104	920	767	613	460	307
40	0.469		198.00	1806	1642	1477	1182	985	821	657	492	328
40	0.500	XS	210.93	1925	1750	1575	1260	1050	875	700	525	350
40	0.562		236.71	2164	1967	1770	1416	1180	984	787	590	393
40	0.625		262.82	2406	2188	1969	1575	1313	1094	875	656	438
42	0.312		138.91	1144	1040	936	749	624	520	416	312	208
42	0.323		143.77	1184	1077	969	775	646	538	431	323	215
42	0.344		153.04	1261	1147	1032	826	688	573	459	344	229
42	0.363		161.42	1331	1210	1089	871	726	605	484	363	242
42	0.375	STD	166.71	1375	1250	1125	900	750	625	500	375	250
42	0.406		180.35	1489	1353	1218	974	812	677	541	406	271
42	0.417		185.19	1529	1390	1251	1001	834	695	556	417	278
42	0.438		194.42	1606	1460	1314	1051	876	730	584	438	292
42	0.450		199.69	1650	1500	1350	1080	900	750	600	450	300
42	0.469		208.02	1720	1563	1407	1126	938	782	625	469	313
42	0.486		215.47	1782	1620	1458	1166	972	810	648	486	324
42	0.500	XS	221.61	1833	1667	1500	1200	1000	833	667	500	333
42	0.562		248.71	2061	1873	1686	1349	1124	937	749	562	375
42	0.625		276.17	2292	2083	1875	1500	1250	1042	833	625	417
42	0.688		303.55	2523	2293	2064	1651	1376	1147	917	688	459
42	0.750		330.41	2750	2500	2250	1800	1500	1250	1000	750	500
42	0.812		357.18	2977	2707	2436	1949	1624	1353	1083	812	541
42	0.875		384.31	3208	2917	2625	2100	1750	1458	1167	875	583
42	1.000		437.87	3667	3333	3000	2400	2000	1667	1333	1000	667
44	0.312		145.57	1092	993	893	715	596	496	397	298	199
44	0.334		155.76	1169	1063	956	765	638	531	425	319	213
44	0.344		160.39	1204	1095	985	788	657	547	438	328	219
44	0.370		172.41	1295	1177	1060	848	706	589	471	353	235
44	0.375	STD	174.72	1313	1193	1074	859	716	597	477	358	239
44	0.406		189.02	1421	1292	1163	930	775	646	517	388	258
44	0.417		194.10	1460	1327	1194	955	796	663	531	398	265
44	0.438		203.77	1533	1394	1254	1003	836	697	557	418	279
44	0.469		218.04	1642	1492	1343	1074	895	746	597	448	298
44	0.476		221.26	1666	1515	1363	1090	909	757	606	454	303
44	0.500	XS	232.29	1750	1591	1432	1145	955	795	636	477	318
44	0.513		238.25	1796	1632	1469	1175	979	816	653	490	326
44	0.556		257.97	1946	1769	1592	1274	1061	885	708	531	354
44	0.562		260.72	1967	1788	1609	1287	1073	894	715	536	358
44	0.625		289.52	2188	1989	1790	1432	1193	994	795	597	398
44	0.688		318.25	2408	2189	1970	1576	1313	1095	876	657	438
44	0.750		346.43	2625	2386	2148	1718	1432	1193	955	716	477
44	0.812		374.53	2842	2584	2325	1860	1550	1292	1033	775	517
44	0.875		403.00	3063	2784	2506	2005	1670	1392	1114	835	557
44	1.000		459.23	3500	3182	2864	2291	1909	1591	1273	955	636
46	0.312		152.24	1045	950	855	684	570	475	380	285	190
46	0.334		162.89	1118	1017	915	732	610	508	407	305	203
46	0.344		167.73	1152	1047	942	754	628	523	419	314	209
46	0.370		180.31	1239	1126	1013	811	676	563	450	338	225
46	0.375	STD	182.73	1255	1141	1027	822	685	571	457	342	228
46	0.406		197.70	1359	1236	1112	890	741	618	494	371	247
46	0.417		203.00	1396	1269	1142	914	761	635	508	381	254
46	0.438		213.13	1466	1333	1200	960	800	667	533	400	267
46	0.469		228.06	1570	1427	1285	1028	856	714	571	428	285
46	0.476		231.43	1594	1449	1304	1043	869	724	579	435	290
46	0.500	XS	242.97	1674	1522	1370	1096	913	761	609	457	304
46	0.513		249.21	1717	1561	1405	1124	937	781	625	468	312
46	0.556		269.85	1861	1692	1523	1218	1015	846	677	508	338

EXHIBIT B
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YIELD 70,000 PSI
E FACTOR = 1.0
T FACTOR = 1.0

NOMINAL PIPE DIA [IN]	WALL THKN [IN]	SCHEDULE NUMBERS	WT PER FT [LBS]	PRESSURE (PSIG) SMYS FACTOR 1.1 SMYS	1.0 SMYS	0.90 SMYS	0.72 SMYS	0.60 SMYS	0.50 SMYS	0.40 SMYS	0.30 SMYS	0.20 SMYS
46	0.562		272.72	1881	1710	1539	1232	1026	855	684	513	342
46	0.625		302.87	2092	1902	1712	1370	1141	951	761	571	380
46	0.688		332.94	2303	2094	1885	1508	1256	1047	838	628	419
46	0.750		362.45	2511	2283	2054	1643	1370	1141	913	685	457
46	0.812		391.87	2718	2471	2224	1779	1483	1236	989	741	494
46	0.875		421.69	2929	2663	2397	1917	1598	1332	1065	799	533
46	1.000		480.59	3348	3043	2739	2191	1826	1522	1217	913	609
48	0.312		158.90	1001	910	819	655	546	455	364	273	182
48	0.334		170.03	1072	974	877	701	585	487	390	292	195
48	0.344		175.08	1104	1003	903	722	602	502	401	301	201
48	0.370		188.21	1187	1079	971	777	648	540	432	324	216
48	0.375	STD	190.74	1203	1094	984	788	656	547	438	328	219
48	0.406		206.37	1303	1184	1066	853	711	592	474	355	237
48	0.417		211.91	1338	1216	1095	876	730	608	487	365	243
48	0.438		222.48	1405	1278	1150	920	767	639	511	383	256
48	0.469		238.08	1505	1368	1231	985	821	684	547	410	274
48	0.476		241.59	1527	1388	1250	1000	833	694	555	417	278
48	0.500	XS	253.65	1604	1458	1313	1050	875	729	583	438	292
48	0.513		260.17	1646	1496	1347	1077	898	748	599	449	299
48	0.556		281.72	1784	1622	1460	1168	973	811	649	487	324
48	0.562		284.73	1803	1639	1475	1180	984	820	656	492	328
48	0.625		316.22	2005	1823	1641	1313	1094	911	729	547	365
48	0.688		347.64	2207	2007	1806	1445	1204	1003	803	602	401
48	0.750		378.47	2406	2188	1969	1575	1313	1094	875	656	438
48	0.812		409.22	2605	2368	2132	1705	1421	1184	947	711	474
48	0.875		440.38	2807	2552	2297	1838	1531	1276	1021	766	510
48	1.000		501.95	3208	2917	2625	2100	1750	1458	1167	875	583

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Distribution Operations

Gas Standard

Effective Date: 10/01/2014	**Service Line Sizing**	Standard Number: **GS 2120.020**
Supersedes: 05/01/2014		Page 1 of 7

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE Code of Federal Regulations - Title 49 - Part 192 - Subpart F

1. GENERAL REQUIREMENTS

Service line sizing shall conform to the guidance contained in this procedure. Installation procedures and typical service line installations are provided in the GS 3020 series of service line construction gas standards.

2. ABBREVIATIONS

The following abbreviations appear in this procedure:

L.P. - Low Pressure
I.P. - Intermediate Pressure
M.P. - Medium Pressure
H.P. - High Pressure
W.C. - Water Column
psig - Pounds per square inch gauge
CTS - Copper tube size
OD - Outside diameter
IPS - Iron pipe size
Mcfh - One thousand cu. ft./hr.
SDR - Standard Dimension Ratio

3. SERVICE LINE PRESSURE DROP

When sizing a service line both the Company and the customer portion of the service shall be treated as a unit. Capacity tables are provided as Exhibits A through D and are based on the following drops which are the recommended pressure drops from main to Meter Set Assembly.

Type Service	L.P.	I.P.	M.P.	H.P.
Pressure Drop	0.5" W.C.	5.0" W.C.* 16.0" W.C.**	16.0" W.C.	2.0 psig

* 1# minimum – 5# maximum system
** 2# minimum – 10# maximum system

4. SERVICE LINE SIZES

The following service line standards have been established:

1/2" CTS (5/8" O.D.) plastic may be used for direct burial and insertion into existing 3/4" or 1" IPS within systems that have a minimum operating pressure of not less than 2 psig. It is the smallest size to be utilized for direct burial. The insertion of 1/2" CTS through 1 1/4" and larger pipe is prohibited, because of the possibility of water in the casing freezing and squeezing off the 1/2" CTS pipe.

1" CTS (1.125" O.D.) plastic is the service line standard size for direct burial and for inserting into 1 1/4" IPS and larger.

1 1/4" IPS or larger size service lines are to be installed only when a smaller service line cannot supply the load.

5. TAP HOLE SIZE

Service line taps shall have a shut-off type tee, and meet the minimum tap hole size requirements of Exhibit E.

6. SIZING INFORMATION

When sizing a service line, consideration shall be given to the:

Minimum Pressure of System

Total length of service line (Customer and Company)

Total rated connected load

Anticipated future load

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Distribution Operations

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EXHIBIT A

Service Line Sizing Tables MCFH

L.P. System
Specific Gravity - 0.6

Based on - 0.5" W.C. Pressure Drop
Flow Formula - Spitzglass

Size		LENGTH, IN FEET 10	50	100	150	200	250	300
Plastic	(PE2406)							
1"	CTS (0.099”)	0.37	0.17	0.12	0.10	0.08	0.08	0.07
1-1/4"	IPS (SDR10)	1.07	0.48	0.34	0.28	0.24	0.22	0.20
2"	IPS (SDR11)	3.16	1.41	1.00	0.82	0.71	0.63	0.58
3"	IPS (SDR11.5)	9.28	4.15	2.94	2.40	2.03	1.86	1.70
4"	IPS (SDR11.5)	18.43	8.24	5.83	4.76	4.12	3.69	3.36
6"	IPS (SDR13.5)	51.82	23.18	16.39	13.38	11.59	10.36	9.46
Steel								
1"	IPS	0.42	0.19	0.13	0.11	0.10	0.08	0.08
1-1/4"	IPS	1.00	0.43	0.30	0.25	0.22	0.19	0.18
2"	IPS	3.76	1.68	1.19	0.97	0.84	0.75	0.69
3"	IPS	12.45	5.57	3.94	3.22	2.79	2.49	2.27
4"	IPS	26.08	11.66	8.25	6.73	5.83	5.22	4.76
6"	IPS	77.27	34.56	24.44	19.95	17.28	15.45	14.11

Tables have allowed for normal fittings.

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Distribution Operations

Gas Standard

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EXHIBIT B

Service Line Sizing Tables MCFH

I.P. System - 1# Min.
Specific Gravity - 0.6

Based on – 5.0" W.C. Pressure Drop
Flow Formula - IGT

Size		LENGTH, IN FEET 10	50	100	150	200	250	300
Plastic	(PE2406)							
¾"	CTS (0.090")	1.16	0.49	0.33	0.25	0.22	0.185	0.145
1"	CTS (0.099")	2.02	0.83	0.56	0.45	0.38	0.34	0.31
1-1/4"	IPS (SDR10)	5.39	2.20	1.59	1.20	1.02	0.90	0.81
2"	IPS (SDR11)	14.87	6.08	4.14	3.30	2.82	2.49	2.25
3"	IPS (SDR11.5)	41.84	17.11	11.64	9.29	7.92	7.00	6.32
4"	IPS (SDR11.5)	81.75	33.43	22.75	18.16	15.48	13.67	12.36
Steel								
1"	CTS (0.099")	2.26	0.92	0.63	0.50	0.43	0.38	0.34
1-1/4"	IPS (SDR10)	4.86	1.99	1.35	1.08	0.92	0.81	0.74
2"	IPS (SDR11)	17.53	1.17	4.88	3.90	3.32	2.93	2.65
3"	IPS (SDR11)	55.68	22.77	15.49	12.37	10.54	9.31	8.42
4"	IPS (SDR11)	115.25	47.13	32.07	25.60	21.82	19.28	17.42

Tables have allowed for normal fittings.

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Gas Standard

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EXHIBIT C

Service Line Sizing Tables MCFH

I.P. and M.P. System - 2# Min.
Specific Gravity - 0.6

Based on – 16" W.C. Pressure Drop
Flow Formula - IGT

Size		LENGTH, IN FEET 10	50	100	150	200	250	300
Plastic	(PE2406)							
1/2"	CTS (0.090")	0.55	0.23	0.15	0.12	0.11	0.09	0.08
3/4“	CTS (0.090”)	1.84	0.76	0.50	0.41	0.36	0.30	0.27
1"	CTS (0.099”)	3.83	1.57	1.07	0.85	0.73	0.64	0.58
1-1/4"	IPS (SDR10)	10.84	4.43	3.02	2.41	2.05	1.81	1.64
2"	IPS (SDR11)	28.18	11.53	7.84	6.26	5.34	4.71	4.26
3"	IPS (SDR11)	79.30	32.43	22.07	17.62	15.01	13.26	11.99
4"	IPS (SDR11)	154.97	63.38	43.12	34.42	29.34	25.92	23.42
Steel								
1"	IPS	4.26	1.74	1.19	0.95	0.81	0.71	0.64
1-1/4"	IPS	9.22	3.77	2.57	2.05	1.75	1.54	1.39
2"	IPS	33.24	13.59	9.25	7.38	6.29	5.56	5.02
3"	IPS	105.54	43.16	29.37	23.44	19.90	17.65	15.95
4"	IPS	218.46	89.34	60.79	48.53	41.36	36.54	33.02

Tables have allowed for normal fittings.

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EXHIBIT D

Service Line Sizing Tables MCFH

H.P. System
Specific Gravity - 0.6

Based on – 2# Pressure Drop
Flow Formula - IGT

Size		LENGTH, IN FEET 10	50	100	150	200	250	300
Plastic	(PE3408)							
1/2"	CTS (0.090")	1.92	0.98	0.69	0.56	0.48	0.42	0.38
3/4“	CTS (0.090”)	5.54	3.11	2.24	1.83	1.58	1.39	1.27
1"	CTS (0.101")	9.99	6.17	4.56	3.75	3.25	2.90	2.64
1-1/4"	IPS (SDR10)	21.39	14.65	11.22	9.37	8.19	7.34	6.70
2"	IPS (SDR11)	26.37	23.58	21.05	19.15	17.67	16.47	15.47
3"	IPS (SDR11)	111.83	90.45	75.13	65.38	58.51	53.34	49.28
Steel								
1/2"	IPS	0.55	0.23	0.15	0.12	0.11	0.09	0.08
1"	IPS	9.16	3.74	2.55	2.03	1.73	1.53	1.38
1-1/4"	IPS	19.80	8.10	5.51	4.40	3.75	3.31	2.99
2"	IPS	71.36	29.18	19.86	15.85	13.51	11.94	10.79
3"	IPS	226.60	92.67	63.05	50.34	42.90	37.90	34.25

Tables have allowed for normal fittings.

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Gas Standard

Effective Date: 10/01/2014	**Service Line Sizing**	Standard Number: **GS 2120.020**
Supersedes: 05/01/2014		Page 7 of 7

EXHIBIT E

Steel Service Lines - Steel Tapping Tees

Main Pressure		Steel Service Line Pipe Size		
		1" IPS (1)(2)	1 1/4" IPS (2)(3)	2" IPS (3)
Low Pressure	(L.P.)	3/4"	3/4"	1"
1 to 10 psig	(I.P.)	3/8"	3/4"	7/8"
2 to 60 psig	(M.P.)	3/8"	3/4"	7/8"
60 to 300 psig	(H.P.)	3/8"	3/4"	7/8"
Over 300 psig	(H.P.)	3/8"	5/8"	7/8"

Notes:

(1) For I.P., M.P. and H.P. 1" service lines a 1/4" punch may be substituted for a 3/8" punch-valve when the pipe wall exceeds 0.280".

(2) Continental: 1416 (1" body) & 9928 (saddle tee) - 3/4" Punch-Valve (3/8" max. for 1 1/4" saddle).
1521 (1 1/4" body w/1" valve) - use Mueller # 78875 or Skinner # 11 cutter for 3/4" L.P. taps.
1302 (3/4" body) - 3/8" Punch-Valve - use only for M.P. or H.P.
Skinner: C8WK6 (1" body) - 3/8" Punch-Valve. Use Continental 3/4" Punch-Valve (P.H. 0000-06-0832) for L.P. taps.
Mueller: No-Blo H-17650 (H-17656 over 250 psig).

(3) Continental: 9923 (2" body) - 1 7/8" max. cutter size (Mueller or WmSon).
Mueller: No-Blo 1 1/4" body or 2" body

Plastic Service Lines - Plastic Tapping Tee

Main Pressure		Plastic Service Line Pipe Size			
		1/2" CTS (1)	1" CTS (2)	1 1/4" (3)	2" IPS (4)
Low Pressure	(L.P.)	N/A	3/4"	3/4"	1 1/4"
1 to 10 psig	(I.P.)	3/8"	3/4"	3/4"	1 1/4"
2 to 60 psig	(M.P.)	3/8"	3/4"	3/4"	1 1/4"
61 to 99 psig	(H.P.)	3/8”	3/4"	3/4"	1 1/4"

Notes:

(1) Dresser 388 - 1/2" cutter

(2) Central E/F - 0.75” cutter; Dresser 388 – 1/2" cutter

(3) Central E/F - 0.75" cutter
Central E/F - 1 1/4" cutter for 2" mains, 1 1/2" cutter for over 2" main size; Continental Super Eliminator 1 ½” cutter.

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Gas Standard

Effective Date: 10/26/2004	**River and Stream Crossings**	Standard Number: **GS 2200.010(CG)** P&P 530-3
Supersedes: N/A		Page 1 of 11

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

This procedure provides information required for the design of river and stream crossings. The GS 3000 series of construction gas standards provides installation guidance. During the design of these crossings, the designer should be familiar with the subsequent Operating & Maintenance (O&M) responsibilities. (Refer to GS 1702.010 or GS 1702.010(KY) "Patrolling Distribution Systems," GS 1704.010 or GS 1704.010(KY) "Patrolling Transmission Lines," and GS 5200.200(CG) or GS 5200.200(MD) or GS 5200.200(PA) or GS 5200.200(VA) "Underwater Pipeline Inspections.")

Bridge crossings are covered in GS 2200.020(CG) "Above Ground Bridge Crossings."

Because of the exposure, public nuisance, and additional liability involved, aerial crossings are to be considered only as a last resort. Where aerial crossings are contemplated, consult a competent engineering design firm to provide design drawings and installation supervision.

Refer to HSE 4440.010(CG) "Environmental Standards For Pipeline Construction" for construction permitting guidance and erosion control requirements in environmentally sensitive areas.

HSE 4440.020(CG) "Storm Water Runoff Reporting Requirements for Construction Projects" provides guidance for time-consuming and complex permitting processes.

2. DEFINITIONS

2.1 Minor River and Stream Crossings

A minor river crossing is an underwater crossing that can be completed using standard distribution pipeline construction equipment, such as a small rubber tired tractor loader-backhoe, ditching machine, etc.

2.2 Major River Crossing

A major river crossing is an underwater crossing that requires using heavy pipeline

construction equipment such as large track mounted backhoe, crane with clamshell bucket or dragline, barge related equipment, gang rock drills, etc. Major river crossings are separate Property Units therefore individual Designed Capital Job Orders are required. (Refer to GS 2810.010(CG) "Initiating an Individual Work Order.")

3. UNDERWATER CROSSINGS

3.1 Metallic Pipe

Mains that will cross areas normally under water or be subject to periodic flooding (e.g., lakes, bays, swamps, rivers) shall be studied during preliminary design to determine if weight or anchorage is required to prevent flotation. During the preliminary design stage of the project, the Operations Engineer shall determine all weighting or anchorage provisions. The following information should be considered:

a. Crossing location and alternates
b. Width - normal and flood levels
c. Water depth - maximum and normal
d. Soil condition of both bank and river bed
e. Current velocity - during construction
f. Available room for construction
g. Possible waterway traffic, if navigable
h. U.S.G.S. topographic map of area

As a general rule, minor underwater crossings may be installed using pipe in the normal installation category in Table 1, of GS 2100.010(CG) "Design - General" and need not be weighted or anchored if the banks are of firm earth. All other crossing designs will be based on the minimum wall for above ground piping of the same table.

Where additional weight is required, the following methods should be considered to obtain the necessary negative buoyancy:

a. use of heavy-wall pipe
b. concrete river weights
c. anchorage devices
d. factory- or field-installed continuous concrete weighting

Water should not be used in a carrier pipe to sink the pipe in the underwater ditch.

Underwater crossings shall be all welded. In addition to the testing requirements of GS 1500.010 or GS 1500.010(OH) "Pressure Testing" non-destructive (x-ray) testing should be considered. Non-destructive and hydrostatic testing is mandatory before installation of major-river and underwater crossings where access or repair would be difficult.

Sag bends rather than weld ells should be considered in planning. Sag bends will normally permit easier installation.

A minimum of four (4) feet of cover in soil or two (2) feet in consolidated rock is required. This cover shall be measured from the dredge line or natural bottom to the top of coated pipe; sediment layer should not be included in the cover measurement.

The decision to use heavier wall pipe, river weights, or continuous concrete weighting is one of economics, availability of materials, and characteristics of the crossings. The following is provided to assist in the determination of the amount of weighting and type to use:

a. Heavier wall pipe - pipe 6" and smaller has adequate weight for providing the necessary negative buoyancy in backfill density of 70#/cu.ft. and is the preferred method. GS 2100.010(CG) "Design - General" sets out minimum wall requirements.

b. River Weights - Exhibit A will provide guidance in estimating the number of river weights necessary for pipe sizes 6 through 16 inch. When the center-to-center (C-C) spacing of the river weight is less than 10 feet, continuous concrete coating should be considered. Exhibit B provides a calculation procedure.

c. Continuous Concrete Coating - is to be considered where the length of the water crossing is in excess of 300 feet and for pipe 16" and larger.

d. From a practical standpoint, the minimum wall thickness for a concrete coating is two (2) inches.

3.1.1 Explanation of Backfill Density

Backfill with the following densities (and related specific gravities – SG) are to be used during underwater pipe installations. The appropriate density is applied in Exhibit A to determine the river weight spacing.

a. 70#/cu.ft. Backfill (1.15 S.G.) represents the material found in the average stream with fairly clear water. Use this when crossing a slow stream with a gravel bed.

b. 80#/cu.ft. Backfill (1.3 S.G.) represents a mucky soil such as a swamp or river with mud bottom. Use this when crossing such

places and where stream velocities are not appreciable.

c. 90#/cu.ft. Backfill (1.45 S.G.) represents an extremely dense mud and is to be used when laying pipe through a mucky soil that is relatively plastic.

3.2 Plastic Pipe

Plastic pipe may be used for underwater crossings if encased in steel pipe to ensure negative buoyancy and physical protection, except as provided in Section 4.1. The steel casing need not be sealed. Protection against shear forces on the plastic pipe at the casing ends shall be considered. To permit utilization of the casing pipe weighting effect, the casing shall be permitted to fill with water or be filled with a material heavier than water such as cement slurry. Plastic pipe crossings shall be weighted according to Exhibit C. Exhibit D provides a calculation procedure for other situations.

Casing for plastic pipe crossings shall extend beyond the expected high-water mark. Casing-spacer use is optional, and generally not used due to the minimal annular space clearance. Plastic pipe shall be butt fused across all water crossings. A minimum of four (4) feet of cover in soil or two (2) feet in consolidated rock is required. This cover shall be measured from the dredge line or natural bottom to the top of casing pipe; sediment layer should not be included in the cover measurement.

3.2.1 Exception to Requirement for Steel Casing of Plastic Pipe

Plastic pipe installed by a directional boring machine, having the capability to control the depth below the river or stream bottom of the pipe installation over the entire bore length, need not be encased in steel pipe provided that all of the following conditions are met:

a. The top of the plastic pipe is installed at a continuous minimum depth of four (4) feet below the dredge line or natural river or stream bottom. The sediment layer should not be included in this measurement.

b. No obvious erosion activity is observed that could expose the approach piping.

c. The river or stream bottom is not disturbed during the installation.

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Gas Standard

Effective Date: 10/26/2004	**River and Stream Crossings**	Standard Number: **GS 2200.010(CG)** P&P 530-3
Supersedes: N/A		Page 5 of 11

EXHIBIT A

River Weights Spacing Chart

Nom. Dia. [in.]	Min. Wall Thickness [in.]	Negative Buoyancy Required [#/cu.ft].	Backfill Density [#/cu.ft.]	River Wt. Spacing C-C [ft.]	River Weight Air Wt. [lbs.]	River Weight Water Wt. [lbs.]	Nom. O.D. [in.]
6	0.280	3.7 5.5 8.8	70 80 90	35(125) 35(71) 35(35)	920	510	21
8	0.322	6.1 11.3 16.5	70 80 90	35(68) 32 18	825	460	21
10	0.365	13.1 21.1 29.1	70 80 90	35(43) 24 15	1200	665	25
12	0.375	25.7 36.8 48.0	70 80 90	19 11 7	1000	550	25
16	0.375	55.6 73.0 90.5	70 80 90	11 7 5	1200	675	28

(1) Heavier wall pipe will add to the 20% safety factor that is incorporated.

(2) Table makes allowance for all type of coatings, thereby providing adequate weighting.

(3) Based on standard concrete river weights approved for purchase. River weight spacing of over 35' C-C is not approved. Figures in parenthesis are the calculated river weight spacings.

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Gas Standard

Effective Date: 10/26/2004	**River and Stream Crossings**	Standard Number: **GS 2200.010(CG)** P&P 530-3
Supersedes: N/A		Page 6 of 11

EXHIBIT B
(1 of 3)

Calculation Procedure for Determining
River Weight Spacing

Data Conditions for Calculations:

Pipe Steel:

O.D.	_____	inches
Wall thickness	_____	inches
Pipe weight	_____	lb./lin.ft.

Coating and Wrap:

Type	_____	
Weight	_____	lb./lin.ft.
Thickness	_____	inches

River Weight:

Weight in air	_____	lb.
Weight in water (62.4#/cu.ft.)	_____	lb.

Calculations For:

Effective Weight of River Weight in Fluid Backfill (Pounds)

The effective weight of the river weight in the fluid backfill generally has to be calculated from the water weight data given by the manufacturer. Generally, the manufacturer will give the data on the air weight and weight in water. The volume may or may not be given.

The following steps will illustrate the common procedure.

$$\text{Volume of the river weight [cu.ft.]} = \frac{\text{Weight in Air - Weight in Water}}{\text{Density of Water (62.4 lbs/cu.ft.)}}$$

Displaced fluid backfill weight [lb.] = Volume x Density of Fluid Backfill

Density of fluid backfill will be 70, 80, or 90 lbs/cu.ft.

Effective weight in fluid backfill [lb.] = Weight in Air - Displaced Fluid Backfill Weight

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Gas Standard

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EXHIBIT B
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Total Buoyancy to Overcome (Pipe and Coating) — Equation

Pipe displacement [cu.ft./lin.ft.] =
$0.005454\ [O.D. + (2 \times \text{coating thickness})]^2$ (1)

Positive buoyancy due to backfill displacement [lbs/lin.ft., pipe] =
backfill density x equation (1) (2)

Weight of wrapped pipe [lbs/lin.ft.] =
weight of pipe + weight of coating and wrap (3)

Positive buoyancy to overcome [lbs/lin.ft.] =
equation (2) - equation (3) (4)

20% negative buoyancy (Safety Factor) [lbs/lin.ft.] =
20% x equation (2) (5)

Total Buoyancy to overcome [lbs/lin.ft.] =
equation (4) + equation (5) (6)

Spacing of River Weights

Spacing of River Weight [lin.ft.] =

$$\frac{\text{Effective Weight of River Weight in Backfill}}{\text{Total Buoyancy to Overcome}}$$

Sample Calculation for Determining River Weight Spacing

Data Conditions for Calculations:

Pipe Steel:

O.D.	10.75 in.
Wall Weight	0.365 in.
Pipe Weight	40.48 lb./lin.ft.

Coating and Wrap:

Type	Thin Film Epoxy
Weight	Negligible
Thickness	Negligible

River Weight:

Weight in Air	1220 lb.
Weight in Water	665 lb.

Backfill density 70 lb./cu.ft.

EXHIBIT B
(3 of 3)

Effective Weight of River Weight in Fluid Backfill:

Volume of the river weight = $\frac{1200 \text{ lb.} - 665 \text{ lb.}}{62.4 \text{ lb./cu.ft.}}$ = 8.574 cu.ft.

Displaced fluid backfill weight = 8.574 x 70 = 600 lb.

Effective weight in fluid backfill = 1200 - 600 = 600 lb

Total Buoyancy to Overcome (Pipe and Coating):

Pipe displacement [cu.ft./lin.ft.] =
0.005454 [10.75 + (2 x negligible thickness)]^2 = 0.6303 cu.ft./lin.ft.

Positive buoyancy due to backfill displacement [lbs/lin.ft., pipe] =
70 x 0.6303 = 44.12 lb./lin.ft.

Weight of wrapped pipe [lbs/lin.ft.] =
40.48 + negligible coating weight = 40.48 lb.

Positive buoyancy to overcome [lbs/lin.ft.] =
44.12 – 40.48 = 3.64 lb./lin.ft.

20% negative buoyancy (Safety Factor) [lbs/lin.ft.] =
20% x 44.12 = 8.824 lb./lin.ft.

Total Buoyancy to overcome [lbs/lin.ft.] =
3.64 + 8.824 = 12.464 lb./lin.ft.

Spacing of River Weights

Spacing of River Weight [lin.ft.] =

$\frac{600}{12.464}$ = 48 ft.

Since spacing over 35 feet is not approved, a 35-foot spacing shall be used.

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Gas Standard

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EXHIBIT C

Plastic Pipe - Casing and Weighting [1]

Plastic Pipe Size [in.]	Plastic Pipe Wt – Air [lbs/lin.ft.]	Negative Buoyancy Required [lbs/cu.ft.] [2]	Recommended Casing Size-Wall [in.]	Excess Wt. Casing in H_20 [lbs/lin.ft.]	Safety Factor
SDR 11 [3]					
1¼	0.32	0.73	3-0.156	4.78	6.4
2	0.64	1.53	4-0.156	6.21	2.5
3	1.38	3.31	6-0.156	9.24	2.0
4	2.29	5.41	8-0.172	13.3	1.8
6	4.97	11.8	10-0.188	18.1	1.3
8	8.24	20.0	12-0.375	42.5	1.6
10	12.8	31.3	12-0.375	42.5	1.2 [4]
12	18.0	44.1	16-0.375	53.6	1.1
SDR 13.5					
3	1.15	3.54	6-0.156	9.24	1.9
4	1.90	5.80	8-0.172	13.3	1.8
6	4.15	12.6	10-0.188	18.1	1.3
8	7.02	21.4	12-0.375	42.5	1.6
10	10.9	33.2	12-0.375	42.5	1.1 [4]
12	15.2	46.9	16-0.375	53.6	1.1 [4]
SDR 17					
6	3.34	13.4	10-0.188	18.1	1.2
8	5.66	22.8	12-0.375	42.5	1.6
10	8.79	35.3	12-0.375	42.5	1.1 [4]
12	12.4	49.7	16-0.375	53.6	1.1 [4]

(1) Table is predicated on allowing casing to fill with water.

(2) Based on a density of backfill of 70 1b./cu.ft.

(3) Safety Factor for SDR 11.5 plastic pipe will approximate SDR 11's very closely.

(4) Annular space must be filled with concrete, etc.

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EXHIBIT D
(1 of 2)

Calculation Procedure for Determining
Weighting Required for Plastic Pipe

Data Conditions for Calculations:

Carrier Pipe:

O.D. _____ inches
Pipe weight _____ lb./lin.ft.

Casing Pipe:

O.D. _____ inches
I.D. _____ inches
Pipe weight _____ lb./lin.ft.

Calculation for:

Carrier Pipe Positive Buoyancy — Equation

Pipe displacement [cu.ft./lin.ft.] =

$$0.005454\ (O.D.)^2 \quad (1)$$

Positive buoyancy due to backfill displacement [lbs/lin.ft., pipe] =

backfill density x equation (1) (2)

Casing Pipe Positive Buoyancy

The effective weight of the casing pipe is calculated on the assumption that the casing will be permitted to fill with water or backfill fluid.

Displacement of casing pipe [cu.ft./lin.ft.] =

$$0.005454\ [(O.D.)^2 - (I.D.)^2] \quad (3)$$

Positive buoyancy due to backfill displacement [lbs/lin.ft.] =

backfill density x equation (3) (4)

Safety Factor

Safety Factor =

$$\frac{\text{Carrier weight + casing weight}}{\text{equation 2 + equation 4}} \quad (5)$$

NOTE: must = 1.2 or greater

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EXHIBIT D
(2 of 2)

Sample Calculation for Determining Weighting
Required for Plastic Pipe

Data Conditions for Calculations:

Carrier Pipe:		Casing Pipe:	
O.D.	4.5 in.	O.D.	8.625 in.
Pipe Weight	2.29 lb./lin.ft.	I.D.	8.281 in.
		Pipe Weight	15.53 lb./lin.ft.

Backfill density = 70 lbs/cu.ft.

Carrier Pipe Positive Buoyancy

Pipe displacement [cu.ft./lin.ft.] =

$$0.005454\ (4.5)^2 = 0.110 \text{ cu.ft./lin.ft.}$$

Positive buoyancy due to backfill displacement [lbs/lin.ft., pipe] =

$$70 \times 0.110 = 7.73 \text{ lb./lin.ft.}$$

Casing Pipe Positive Buoyancy

Displacement of casing pipe [cu.ft./lin.ft.] =

$$0.005454\ [(8.625)^2 - (8.281)^2] = 0.0317 \text{ cu.ft./lin.ft.}$$

Positive buoyancy due to backfill displacement [lbs/lin.ft.] =

$$70 \times 0.0317 = 2.22 \text{ lb./lin.ft.}$$

Safety Factor

Safety Factor =

$$\frac{2.29 + 15.53}{7.73 + 2.22} = 18$$

NOTE: Safety Factor is greater than 1.2 without additional weights.

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Gas Standard

Distribution Operations

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Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE Part 192 - §§ 192.159, 192.321(h), 192.479, 192.481, 192.613, 192.707 and 192.721

1. GENERAL

The installation of a gas pipeline on a bridge structure should be considered only when other alternatives are not reasonably feasible. Pipelines on a structure normally have high maintenance costs, may not be readily accessible for repair, and are subjected to higher than normal secondary stresses.

Certain states have established policies which prohibit or seriously restrict the placement of pipelines on bridges. The Operations Engineer should contact the responsible bridge authority prior to starting any detailed engineering. This contact can establish:

a. whether the pipeline installation will be considered by the authority;
b. the age of the bridge;
c. the future replacement plans;
d. the availability of bridge plans;
e. suggested locations for the gas pipeline by the bridge authority engineer, and
f. any special installation requirements.

If it is necessary to install a pipeline on a bridge structure, the Operations Engineer shall be responsible for the design of the installation in conjunction with the bridge authority. If special design assistance is needed, an engineering consultant may be contacted as needed.

Upon learning that a bridge is scheduled for construction or replacement, the Company should make a prompt determination of an existing or future need to maintain gas facilities on the bridge. If the determination suggests that there is an existing or future need for gas facilities on the bridge, this should be communicated to the authority having responsibility as promptly as possible in order to be considered in the bridge design.

2. DESIGN CONSIDERATIONS

Exhibits A and B are provided to assist in the development of a bridge plan.

2.1 Carrier Pipe

The exposed pipe shall conform to the minimum wall standards of GS 2100.010(CG) "Design - General."

2.1.1 Steel

Steel piping will extend beyond the bridge approach slabs or 40 feet from the head wall, whichever is greater.

Where buried plastic pipe is involved at the approaches to the bridge, the transition shall be at a point where bridge related secondary stresses are minimized.

2.1.2 Plastic

While steel carrier piping is preferred, there may be conditions that justify the use of a plastic pipe for bridge crossings if the design takes into account vandalism, possible thermal stress, ultra-violet degradation, and possible reduction in the mechanical properties of plastic pipe.

Plastic pipe may be installed on bridges, provided that it is:

1. Installed with protection from mechanical damage, such as installation in a metallic casing;
2. Protected from ultraviolet radiation; and
3. Not allowed to exceed the pipe temperature limits (see GS 2100.010(CG) "Design – General").

Approval of the installation shall be obtained from the Manager, Engineering.

2.2 Support or Hangers

Support or hangers shall allow for the free movement of the exposed piping.

Recommended spacing of supports for steel piping and casing is as follows:

Nominal Pipe Size:	1¼	2"	3"	4"	6"	8"	10"	12"	16"	20"
Supporting Spacing:	9'	10'	12'	14'	17'	19'	22'	23'	27'	30'

2.3 Expansion (Contraction) Provisions

Steel piping will expand or contract ¾ inch per 100 feet for 100°F temperature change. Therefore, aboveground piping is subject to greater expansion (contraction) than buried piping due to the greater change in temperature. Expansion provisions are not required on bridge crossings less than 100 feet (abutment to abutment).

Plastic piping will expand (contract) 11 inches per 100 feet for 100°F temperature change. Provisions for thermal expansion (contraction) of plastic piping are very important, especially since it will expand (contract) a different amount than a metallic casing, if used. The use of plastic carrier piping should be limited to shorter lengths.

To reduce stress due to expansion (contraction), the preference is for an expansion loop to be incorporated into the bridge crossing design. The type of expansion loop depends on the type of bridge construction, carrier pipe material, and if metallic casing is used for plastic carrier piping.

When the bridge design will not accommodate an expansion loop, an expansion joint can be considered. The expansion joint shall be designed and installed in accordance with Section 3 and maintained in accordance with Section 4.2.

2.4 Joining

All pipeline joints shall be welded except for expansion joints designed into the bridge plans. The installation of mechanical couplings is prohibited in any exposed piping and the approaches to the bridge where movement could be experienced.

2.5 Cathodic Protection

Steel carrier pipe shall be insulated at each end of the bridge beyond the approach slab. Extreme care shall be exercised to ensure that the carrier pipe is electrically isolated from the bridge structure to maintain cathodic protection on any buried steel portions. Refer to GS 1420.070 “Corrosion Control Design-Electrical Isolation and Insulation.”

2.6 Atmospheric Corrosion

For atmospheric corrosion control, refer to GS 1450.010, GS 1450.010(PA), or GS 1450.010(VA) "Atmospheric Corrosion."

2.7 Valves

The installation of valves on each side of the bridge shall be considered as part of the overall program objective that makes it possible to isolate portions of the distribution system including bridge crossings. Valves should be installed in close proximity to the bridge beyond the point where abutment movement could be experienced. Refer to GS 2400.010, GS 2400.010(KY), or GS 2400.010(PA) "Critical Valve Design Guidelines."

2.8 Test Requirements

Testing requirements shall be in accordance with GS 1500.010 or GS 1500.010(OH) "Pressure Testing." In certain situations it may be desirable to perform a separate in-place pressure test on exposed piping prior to the tie-in. Consideration should also be given to non-destructive testing of bridge crossing welds.

2.9 Marking

Form C-2886, "Caution Gas Pipeline Sticker," and Form C-2505-XX, "Call Before You Dig Pipeline Marker Sticker," Exhibit C shall be placed and maintained on or along the exposed piping that is accessible to the public.

3. INSTALLING EXPANSION JOINTS

Refer to Material Catalog Groupid 21-87B for approved expansion joints.

A company representative familiar with the expansion joint shall review the manufacturer's installation instructions and be present during installation of the expansion joint to assure that it is correctly set for the temperature at time of installation and properly supported and aligned.

4. INSPECTION AND MAINTENANCE REQUIREMENTS

4.1 Pipelines

All above ground pipelines on bridge structures shall be considered for inclusion into the Company's patrolling program as described in GS 1702.010 or GS 1702.010(KY)

"Patrolling Distribution Systems," and, if included, shall be patrolled on frequencies stated within that procedure.

All above ground steel pipelines and casings on bridge structures which are exposed to the atmosphere shall be inspected for atmospheric corrosion in accordance GS 1450.010, GS 1450.010(PA), or GS 1450.010(VA) "Atmospheric Corrosion."

4.2 Expansion Joints

Maintenance inspections of each mechanical expansion device shall be performed annually. This maintenance inspection should be accomplished during the winter months.

It is recommended the annual maintenance inspection of the installed expansion joints be established as a patrolling repetitive task in WMS to assure its accomplishment.

The annual maintenance inspection will consist of:

a. Checking the bolts used to compress the packing to make sure the nuts are tight. In the event leakage is evident, tighten bolts on the packing gland until leakage stops.

b. As necessary, cleaning the slip pipe and then coating with a non-petroleum base grease such as Dow-Corning DC-111 or an equivalent grease.

c. Cleaning and recoating bolts, body cylinders and follower rings if atmospheric corrosion or excessive rust is observed.

d. Checking supports and guides to insure proper alignment of the slip pipe and body cylinder.

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EXHIBIT A
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DESIGN CONSIDERATIONS FOR ABOVE GROUND BRIDGE CROSSINGS

General Design Consideration Factors:

a. Potential obstruction to stream flow and/or a reduction of waterway opening.

b. Potential danger to pipeline facility by stream flow.

c. Vehicular clearance requirements (trucks, trains, etc.).

d. Accessibility for construction, inspection, and maintenance.

e. Level of difficulty of initial installation (e.g., bridge is over a freeway and special falsework would need to be erected for the pipeline installation).

f. Detailed investigation of impact forces may be desired for "flexible" bridges with heavy vehicular traffic.

g. Pipe location should not unduly interfere with bridge maintenance and painting.

h. Pipe and supporting system members should be available for periodic inspection without specialized equipment.

i. By location or special features, pipe and supporting system members should be protected from deck-surface drainage.

j. Pipeline should be electrically isolated from the bridge structure by utilizing insulated rollers in hangers, insulating spacers in sleeves through abutments, and no welding of supports directly to the pipeline.

k. Check for other utility facilities also attached or proposed to be attached to the bridge.

Detail Design Consideration Factors:

a. Perform expansion/contraction provision analysis for design of pipeline loop(s) or expansion joint.

b. Identify possible pipeline routes possible through and/or around the bridge abutments, wing walls, and approach slabs.

c. Non-threaded methods of fastening load bearing components of the pipeline support system should be favored over threaded types due to the increased vulnerability of threaded fasteners to corrosion.

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EXHIBIT A
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d. Examine crossframe and endframe match-up when pipeline is routed through abutment walls.

e. Avoid bridge structure and roadway underdrains.

f. Modification of and/or impact to concrete reinforcing steel patterns.

g. The pipe and its supporting system members should be above the lowest structural bridge member.

h. Preferably, pipe located outside the parapet should be on the downstream side of water crossing bridge.

i. Consideration should be given to additional corrosion control where pipelines exit casings and/or sleeves at the abutment wall, such as casing spacers, casing filler, link seals, boots, etc.

j. If the carrier pipe exits the bridge around the abutment wall, consider pipe stabilization.

<u>Consideration Factors for Bridge Types and Components</u>:

a. Proposed structures will have different planning, scheduling and component requirements than an existing structure.

b. Steel beam and concrete deck is the most likely type of bridge to accept a pipeline attachment.

c. Built-up girder with stiffener ribs may reduce lateral clearances in bays.

d. Parapets offer an attachment surface on the outside if no expansion provision is needed.

e. Concrete slab deck with metal guardrail bridges are difficult to comply with all preferable design criteria; avoid attaching to the guardrail, as this exposes the pipeline to damage by vehicular accidents.

f. New monolithic concrete bridges need anchors cast in place. Existing monolithic bridges require cutting or drilling anchors into place.

g. Pre-cast concrete and pre-stressed concrete girders, same concerns as monolithic structures and avoid compromising its structural integrity.

h. Vertical wall abutments with wing walls may present difficult installation situations.

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Consideration Factors for Scheduling and Installation Methods:

a. Concurrent with bridge construction, coordination with the bridge owner or controlling agency is required.

b. Incorporate hanger components and abutment openings into bridge design and construction with pipeline installation after completion of bridge (requires suspension of gas flow).

c. Utilization of temporary pipeline installations during bridge construction, thence making permanent attachment after the new bridge is complete (also requires coordination with bridge owner).

d. On-site modifications to an existing structure (e.g., welding to steel components, cutting through abutments, drilling into existing concrete surfaces for anchors, etc.).

e. Check compatibility with other utility facility installation schedules.

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EXHIBIT B

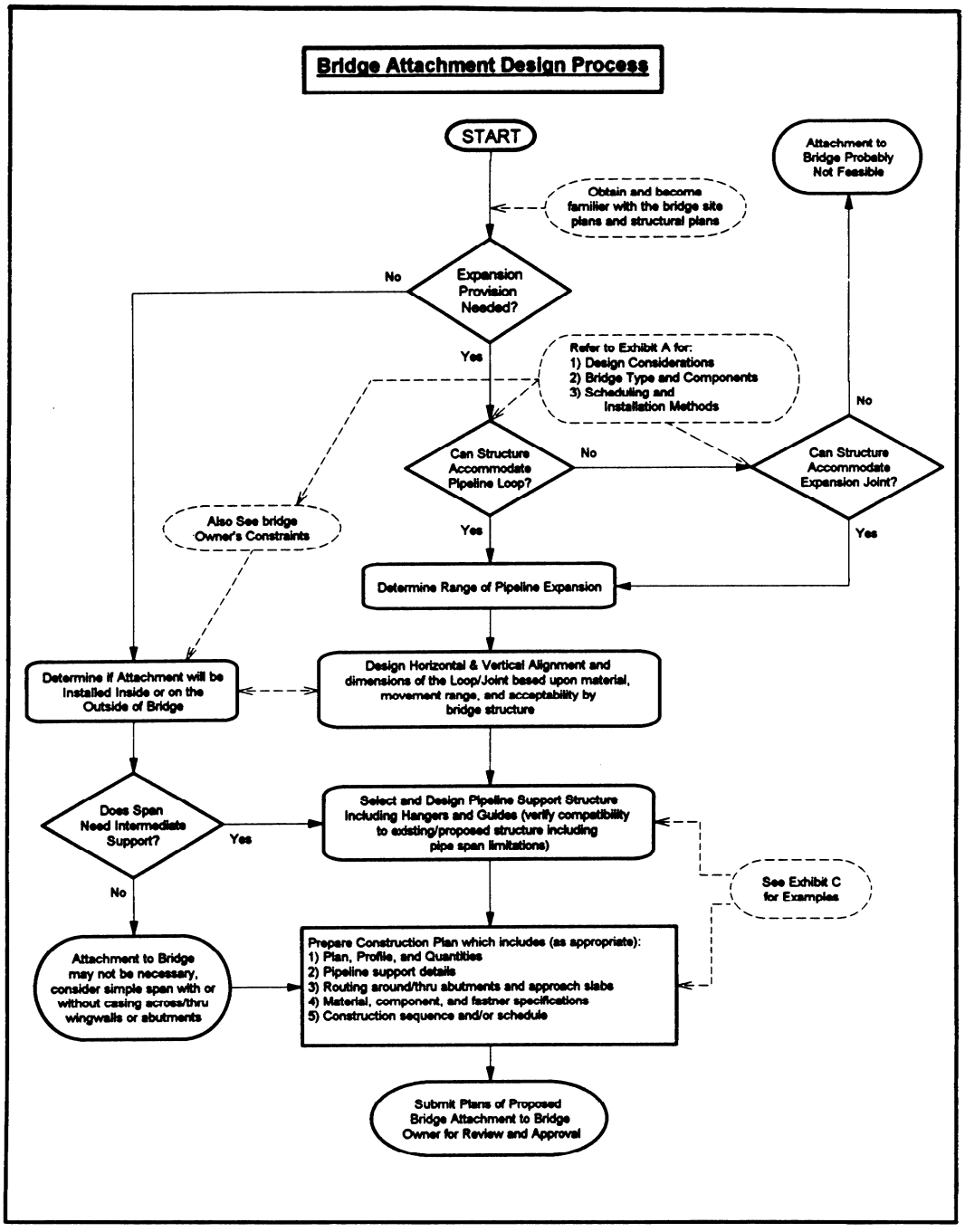

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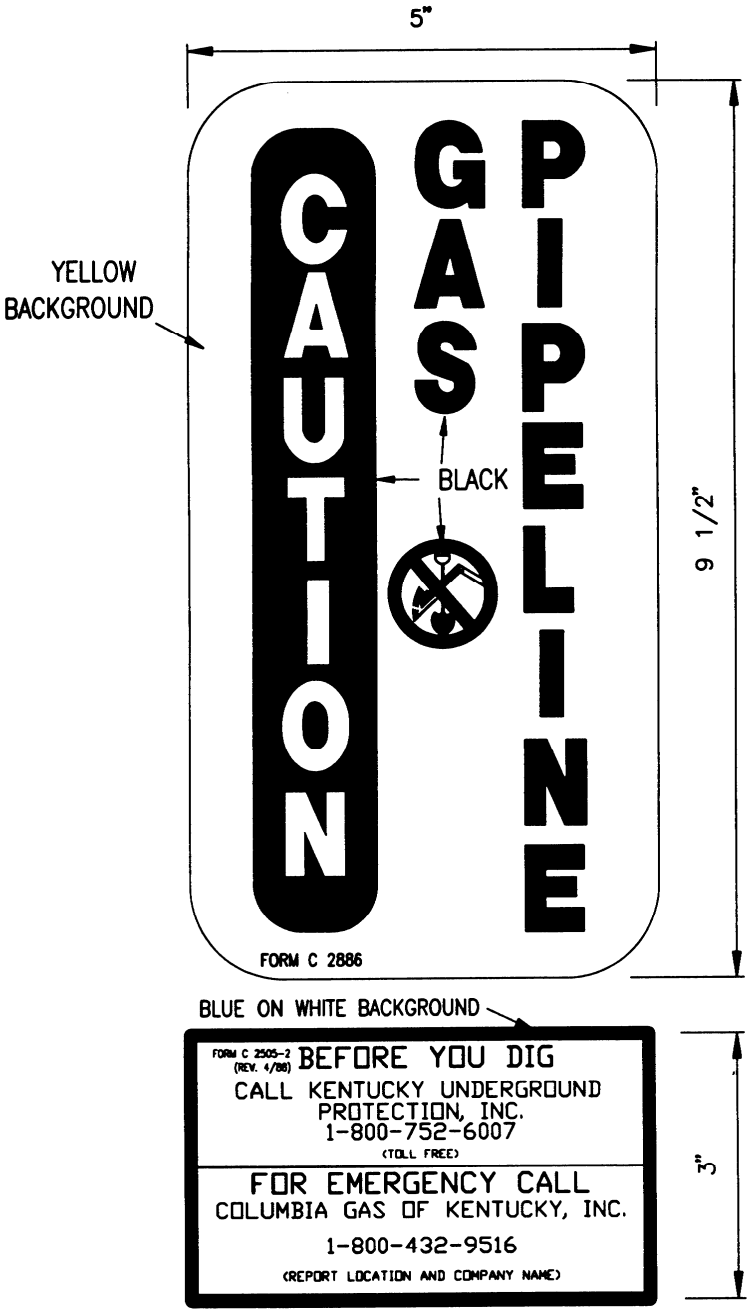
EXHIBIT C



Gas Standard

Distribution Operations

Effective Date: 03/05/1996	**Road Crossings**	Standard Number: **GS 2200.030(CG)** P&P 530-4
Supersedes: N/A		Page 1 of 5

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE Code of Federal Regulations - Title 49 - Part 192 - §192.707

1. GENERAL

Design criteria for road crossings vary according to:

a. Classification
   1. Limited access highways.
   2. Controlled access highways.
   3. State/Federal highways.
   4. County/Township roads.
   5. Municipal roads (city streets).
   6. Turnpikes.
   7. Private roads.

b. Location
   8. Inside corporation.
   9. Outside corporation.

Terms of the original construction funding or the manner in which maintenance funds are administered establishes the amount of jurisdiction a governmental agency has. Jurisdictional boundaries, special design requirements, and permitting requirements can be ascertained through contacts with local, County, or State Highway Department Utility Coordinators. Engineering - Civil Engineering can also be of assistance.

2. DEPTH

Uncased pipeline crossings under roads will have the cover specified in GS 3010.090 "Cover," unless more stringent requirements apply.

When casing is installed, the cover shall be measured to the top of the casing. It is recommended that mains have 3 feet of cover within the road right-of-way wherever practical.

3. CASING

Casing should be installed only when it is:

a. required by the governmental authority.

b. needed to provide protection against greater than normal secondary stresses.

c. required as a construction technique to achieve the bore or alignment.

d. advantageous to do so, e.g. conduit is installed in advance of main line construction.

Plastic pipe may be used for casing for both steel or plastic carrier pipe if the permitting agency approves the installation.

Casing ends shall be sealed with the exception of plastic conduit. Vents shall be installed when required by a governmental agency.

Exhibit A depicts a standard cased road crossing. Further information regarding the installation of casing can be found in GS 3010.070 “Casing.”

Casing shall conform to the following table:

Casing and Carrier Pipe Size

Casing	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"
Carrier Pipe Size	2"	3"	4"	6"	8"	10"	12"	16"	18"	20"	24"

If casing size recommended is not available, use next larger size.

4. CASING FILLER

An approved casing filler shall be used when steel pipe is inserted in steel or plastic casing. Refer to Material Catalog Groupid M-24 for approved casing fillers. Casing filler is used to:

a. accomplish corrosion control.

b. prevent water from entering the casing.

c. minimize frost heaving.

Information regarding the installation of casing filler can be found in GS 3010.070 “Casing.”

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5. ELECTRICAL ISOLATION OF CASING

Casing installations shall be designed to isolate the steel carrier pipe from the casing and adjacent structures. Approved insulating spacers shall be used within casing with steel carrier pipe (refer to Exhibit A and Material Catalog Groupid 42-55A).

6. SAG BENDING

Sag bending is a method which should be considered when it is necessary to install a pipeline at a required depth under a road. The technique is only applicable to open cut and directional bore installations. Exhibit B illustrates a sag bend. Engineering - Civil Engineering shall be contacted when considering such installations.

7. VALVES

The installation of valves shall be considered as part of the overall program objective that makes it possible to isolate portions of the distribution system including road crossings. Refer to GS 2400.010, GS 2400.010(KY), or GS 2400.010(PA) “Critical Valve Design Guidelines” or GS 2400.020 “Transmission Line Valve Design Requirements.”

8. JOINING

Welding and fusing are the preferred joining methods for carrier pipe under paved areas, highway berms and road crossings.

9. MARKING

A line marker shall be placed and maintained at each road crossing, except where impractical. The recommended method of permanently marking the location of a road crossing involving casing is to weld 2 inch vent pipe to the casing as reflected on Exhibit A. Additional information regarding the placement of line markers can be found in GS 1720.010 “Line Markers for Mains and Transmission Lines.”

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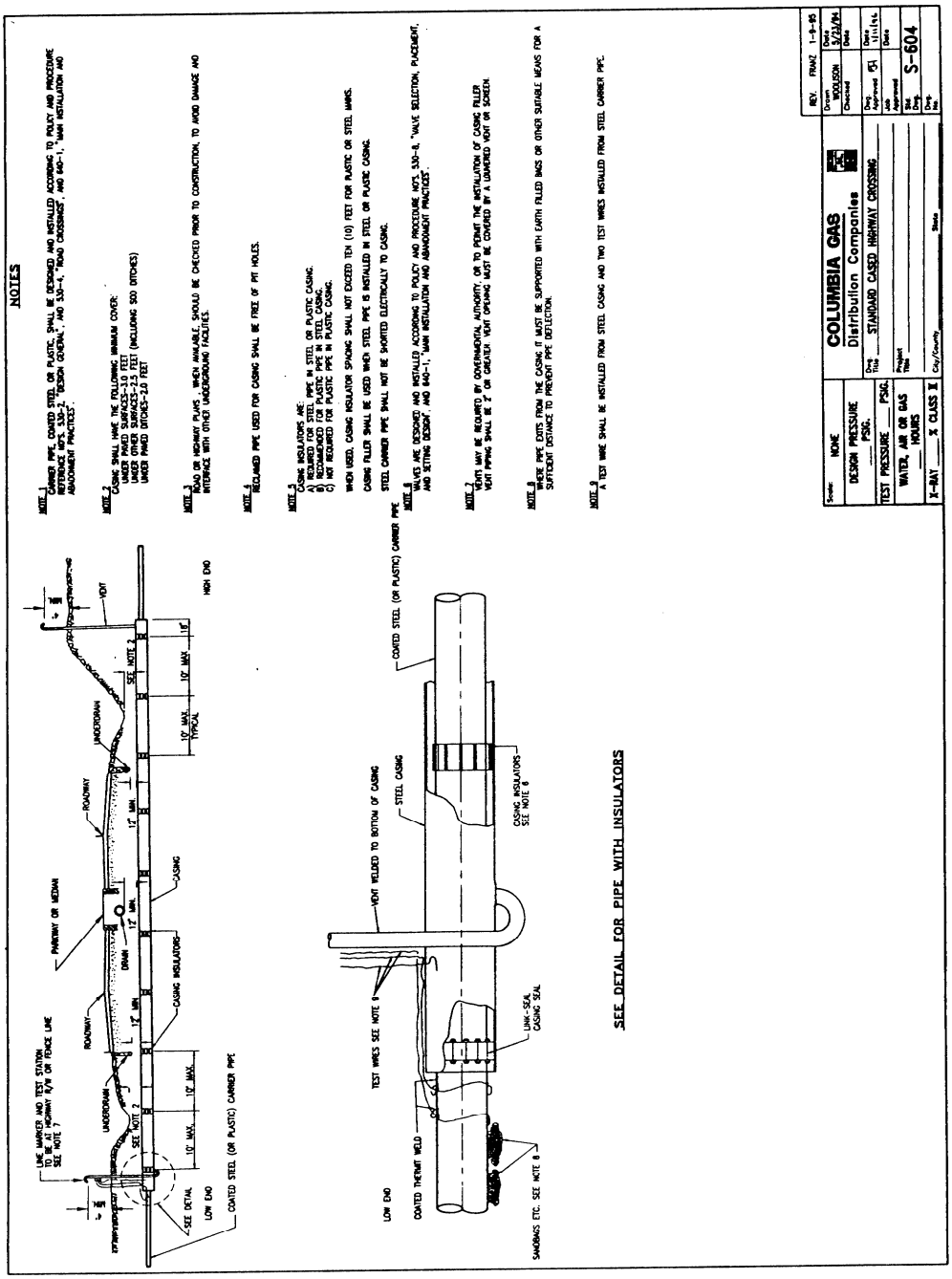

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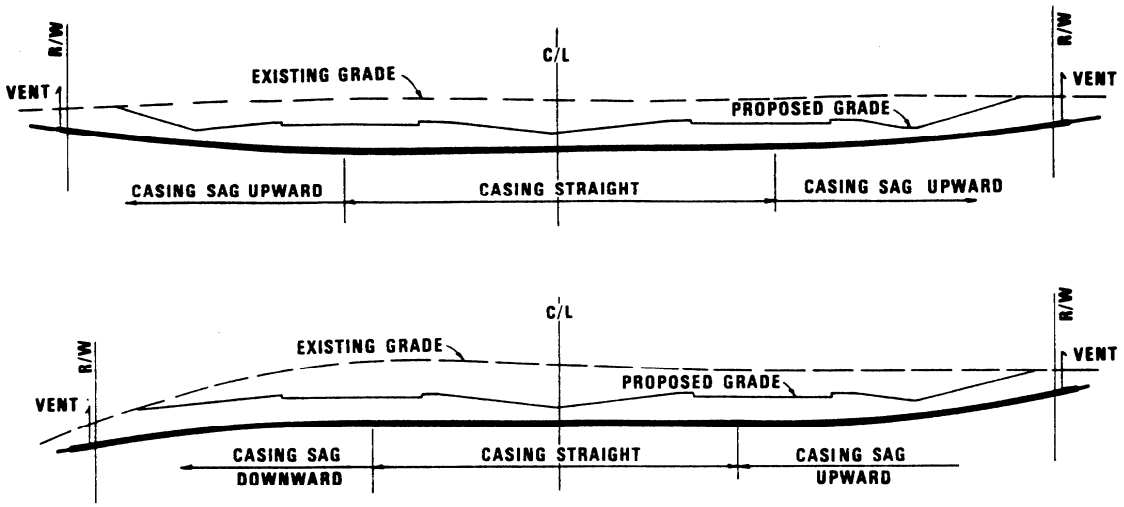
Gas Standard

Effective Date: 03/05/1996	**Road Crossings**	Standard Number: **GS 2200.030(CG)** P/P 530-4
Supersedes: N/A		Page 5 of 5

EXHIBIT B



TYPICAL SAG BENDS

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/01/2013	**Railroad Occupancy Requirements**	Standard Number: **GS 2200.040**
Supersedes: N/A		Page 1 of 6

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE Code of Federal Regulations – Title 49 – Part 192 - § 192.707

1. GENERAL INFORMATION

Design criteria for railroad crossings and parallel installations are based on parts of the American Railway Engineering Association & Maintenance of Way (AREMA) specifications. Individual railroads may have different design requirements.

The necessity of crossing railroads on private property and longitudinal occupancy of railroad property should be carefully evaluated because of the associated long-term fees. The Survey and Land Department will assist in this area to help avoid such situations.

Whenever a railroad crossing is contemplated, a request for permit shall be considered. WMS Report No. WLB1500, "Civil Engineering, Graphics, and Land Services Request," (Exhibit A), shall be generated and transmitted to The Survey and Land Department if any portion of a pipeline is on railroad property. Form GS 2200.040-001, "Plan for Railroad/Railway Application," (Exhibit B), can be completed and submitted to The Survey and Land Department if the Operating Center has the Civil Engineering (surveying) capability.

All applications for permits shall be submitted to the railroad by The Survey and Land Department. Operating Centers will be notified by The Survey and Land Department when approval is received. Operating personnel should recognize that it takes approximately three (3) months to obtain permit approval.

Where a pipeline crossing of a railroad is completely within the right-of-way of a dedicated street a railroad permit is not required. However, Field Engineering shall notify the local railroad authority of the proposed crossing. Plans and a description of proposed work should be submitted to the railroad authority at least 30 days prior to construction.

Note: Plastic carrier pipeshall be considered for applications of 60 psig or less when the pipeline is installed at railroad crossings that do not require a railroad permit unless the railroad authority objects to the use of plastic pipe during the notification process.

2. PIPE DESIGN REQUIREMENTS

Pipeline crossings shall be of sufficient strength to resist forces exerted by the overburden

and rail traffic. Pipeline toolbox is the recommended design assistant for cased and uncased crossings and plastic and steel pipe.

3. PERMIT CONSIDERATIONS

Exhibit C condenses the information required for submitting a railroad permit and sets forth Columbia's minimum design requirements. The following additional information should be considered:

3.1 Parallel Occupation

Pipelines installed longitudinally on railway rights-of-way shall be located as far as practicable from any tracks or any other important structure and be of a design approved by the railroad.

3.2 Carrier Pipe

Carrier pipe should be plastic for applications of 60 psig or less if permitted by the railroad authority.

3.3 Casing Requirements

Refer to GS 3010.070 “Casing” for casing requirements.

3.4 Cover

Refer to the GS 3010.090 “Cover” series of standards for cover requirements

4. CASING FILLER

Information regarding the installation of casing filler can be found in GS 3010.070 “Casing.”

5. ELECTRICAL ISOLATION OF CASING

Electrical isolation from adjacent railroad structures is imperative to prevent interference with railroad signals, avoid corrosive situations, etc.

Refer to GS 3010.070 “Casing” for information regarding electric isolation between the casing and the carrier pipe.

6. VALVES

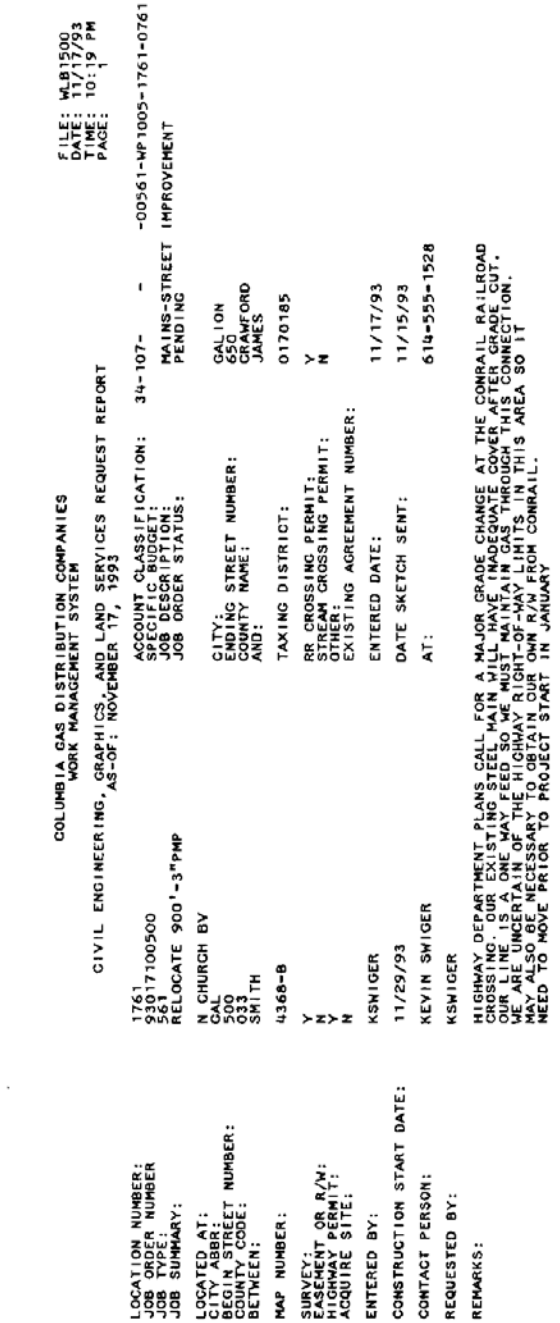
The installation of valves should be considered as part of the overall valve program objective that makes it possible to isolate a portion of the distribution system including railroad crossings. Refer to GS 2400.010, GS 2400.010(KY), or GS 2400.010(PA) “Critical

Valve Design Guidelines" or GS 2400.020 "Transmission Line Valve Design Requirements."

7. MARKING

A line marker shall be placed and maintained on both sides of each railroad crossing, except where impractical. The recommended method of permanently marking the location of a railroad crossing involving casing is to weld 2 inch vent pipe to the casing as reflected on Exhibit C. Additional information regarding the placement of line markers can be found in GS 1720.010 "Line Markers for Mains and Transmission Lines."

EXHIBIT A



COLUMBIA GAS DISTRIBUTION COMPANIES
WORK MANAGEMENT SYSTEM
CIVIL ENGINEERING, GRAPHICS, AND LAND SERVICES REQUEST REPORT
AS-OF: NOVEMBER 17, 1993

FILE: WLB1500
DATE: 11/17/93
TIME: 10:19 PM
PAGE: 1

LOCATION NUMBER: 1761 ACCOUNT CLASSIFICATION: 34-107- - -00561-WP1005-1761-0761
JOB ORDER NUMBER 93017100500 SPECIFIC BUDGET:
JOB TYPE: 561 JOB DESCRIPTION: MAINS-STREET IMPROVEMENT
JOB SUMMARY: RELOCATE 900'-3"PMP JOB ORDER STATUS: PENDING

LOCATED AT: N CHURCH BY CITY;
CITY ABBR: GAL ENDING STREET NUMBER: GALION
BEGIN STREET NUMBER: 500 COUNTY NAME: 650
COUNTY CODE: 033 AND: CRAWFORD
BETWEEN: SMITH JAMES

MAP NUMBER: 4368-B TAXING DISTRICT: 0170185

SURVEY: Y RR CROSSING PERMIT: Y
EASEMENT OR R/W: N STREAM CROSSING PERMIT: N
HIGHWAY PERMIT: N OTHER:
ACQUIRE SITE: N EXISTING AGREEMENT NUMBER:

ENTERED BY: KSWIGER ENTERED DATE: 11/17/93

CONSTRUCTION START DATE: 11/29/93 DATE SKETCH SENT: 11/15/93

CONTACT PERSON: KEVIN SWIGER AT: 614-555-1528

REQUESTED BY: KSWIGER

REMARKS: HIGHWAY DEPARTMENT PLANS CALL FOR A MAJOR GRADE CHANGE AT THE CONRAIL RAILROAD CROSSING. OUR EXISTING STEEL MAIN WILL HAVE INADEQUATE COVER AFTER GRADE CUT. OUR LINE IS A ONE WAY FEED SO WE MUST MAINTAIN GAS THROUGH THIS CONNECTION. WE ARE UNCERTAIN OF THE HIGHWAY RIGHT-OF-WAY LIMITS IN THIS AREA SO IT MAY ALSO BE NECESSARY TO OBTAIN OUR OWN R/W FROM CONRAIL.
NEED TO MOVE PRIOR TO PROJECT START IN JANUARY

NiSource
Distribution Operations

Gas Standard

Effective Date: 11/01/2013	**Railroad Occupancy Requirements**	Standard Number: **GS 2200.040**
Supersedes: N/A		Page 5 of 6

EXHIBIT B

Form
GS 2200.040-001

COLUMBIA GAS DISTRIBUTION COMPANIES
PLAN FOR RAILROAD/RAILWAY APPLICATION

Gas Pipeline crossings will comply with AREMA Specifications and be installed per NiSource Companies drawings

PIPELINE DATA		
PIPE WITHIN R/W	CARRIER PIPE	CASING PIPE
CONTENTS		
OPERATING PRESSURE		
DIAMETER		
WALL THICKNESS		
WEIGHT PER FOOT		
MATERIAL		
SPEC./GRADE		
TEST PRESSURE		
TYPE OF JOINT		
TYPE OF COATING		
METHOD/INSTALLATION		

Company

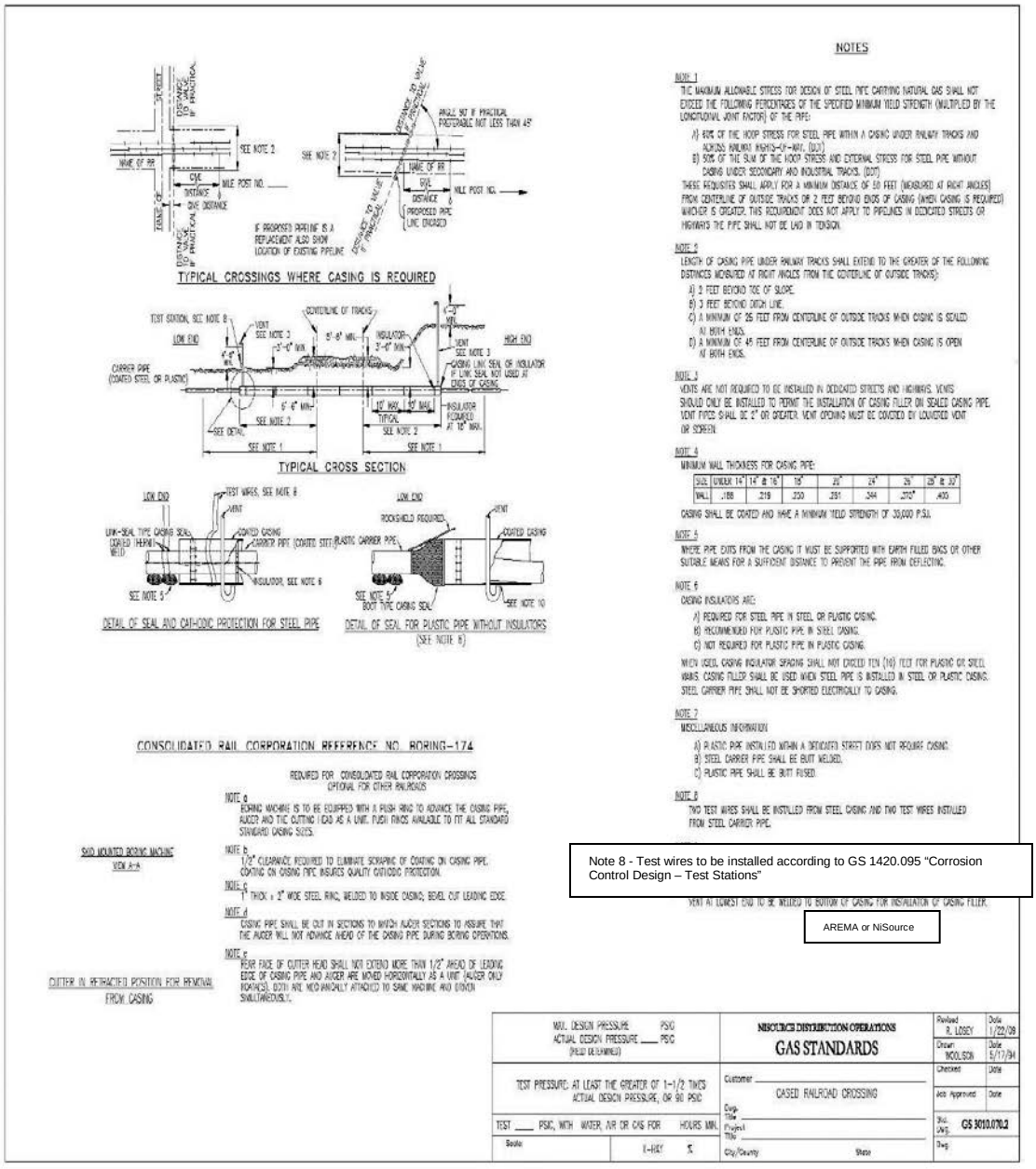
RAILROAD/RAILWAY		
MUNICIPALITY	COUNTY	STATE
ENGINEER	DRAWN BY	F.B. PAGE
MAP NO.	DATE ISSUED	DATE REVISED
WORK ORDER NO.		
LEASE NO.	DRAWING NO.	

NiSource
Distribution Operations

Gas Standard

Effective Date: 11/01/2013	**Railroad Occupancy Requirements**	Standard Number: **GS 2200.040**
Supersedes: N/A		Page 6 of 6

EXHIBIT C



MiSource
Distribution Operations

Gas Standard

Effective Date: 06/01/2012	**Pipeline Flexibility, Supports and Anchors**	Standard Number: **GS 2220.020(CG)** P&P 530-7
Supersedes: 09/28/1987		Page 1 of 3

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE 49 CFR - Part 192 - Subpart D - §§ 192.159 and 192.161

1. GENERAL

Each pipeline must be designed with enough flexibility to prevent thermal expansion or contraction from causing excessive stresses in the pipe or components, excessive bending or unusual loads at joints, or undesirable forces or moments at points of connection to equipment, or at anchorage or guide points. Therefore, pipe must be designed with sufficient wall thickness, or must be installed with adequate protection, to withstand anticipated external pressures and loads that will be imposed on the pipe after installation. Refer to GS 2100.010(CG) "Design General" for minimum wall thickness recommendation for steel pipe.

The thermal expansion to be considered is that caused by the difference between the normal construction temperature and the maximum and minimum expected operating temperature. Thermal expansion of steel piping at various temperatures is shown on Exhibit A. Plastic pipe contraction can amount to 6" to 7" per 100' per 50 degrees F. drop in temperature.

Each support or anchor on an exposed pipeline must be made of durable, noncombustible material.

Compliance with the requirements of the joining procedures of the Company's welding manual and Joining Manual (JM 1300 series of gas standards) will assure that the joints will withstand the anticipated stresses caused by thermal expansion.

2. FLEXIBILITY DESIGN FOR ABOVE GROUND PIPING

Flexibility may be provided by the use of bends, loops, offsets, or expansion joints (not of the slip-joint coupling design). If expansion joints are used to provide flexibility, anchors or ties are required that will provide restraint for all end forces.

Stress intensification and flexibility factors in components other than plain straight pipe shall be considered. Calculations may be required only where reasonable doubt exists as to the adequate flexibility of the system and shall be performed by Engineering - Facilities Planning Section.

3. ANCHORS

Longitudinal forces caused by bends or offsets in buried piping must be resisted by anchorage at the bend, by restraint due to soil friction, or by longitudinal stresses in the pipe. If pipe is anchored by bearing at a bend, care shall be taken to distribute the load so that the bearing pressure of the soil is within safe limits. Where there is doubt as to the adequacy of anchorage by soil friction, calculations shall be made in accordance with an authoritative source, and the indicated anchoring installed.

If anchorage is not provided at the bend, pipe joints which are close to the points of thrust origin shall be designed to sustain the longitudinal pullout force. If not, suitable bracing or strapping of a sufficient number of joints must be provided and the indicated anchoring installed.

4. SUPPORT

Uniform and adequate support of the pipe in the trench is essential. Unequal settlements may produce added bending stresses in the pipe. Lateral thrusts at branch connections may greatly increase the stresses in the branch connection itself, unless the fill is thoroughly consolidated or other provisions are made to resist the thrust. Where vertical branch connections, such as blowoffs, are used, thrust blocks should be installed to absorb reaction thrusts.

Suitable spring hangers, sway bracing, etc., shall be provided where necessary.

If compression or sleeve-type couplings are used, provisions shall be made for longitudinal forces. Suitable bracing or strapping shall be provided if such provisions are not made in the manufacture of the coupling. However, such design must not interfere with the normal performance of the coupling or with its proper maintenance.

Structural supports or anchors may not be welded directly to piping designed to operate at a hoop stress of 50 percent or more of the specified minimum yield strength. If less than 50 percent, direct welding is permitted, provided no vibration or pulsation is present or anticipated. The connection of the structural supports to the pipe shall be by continuous, rather than intermittent, welds.

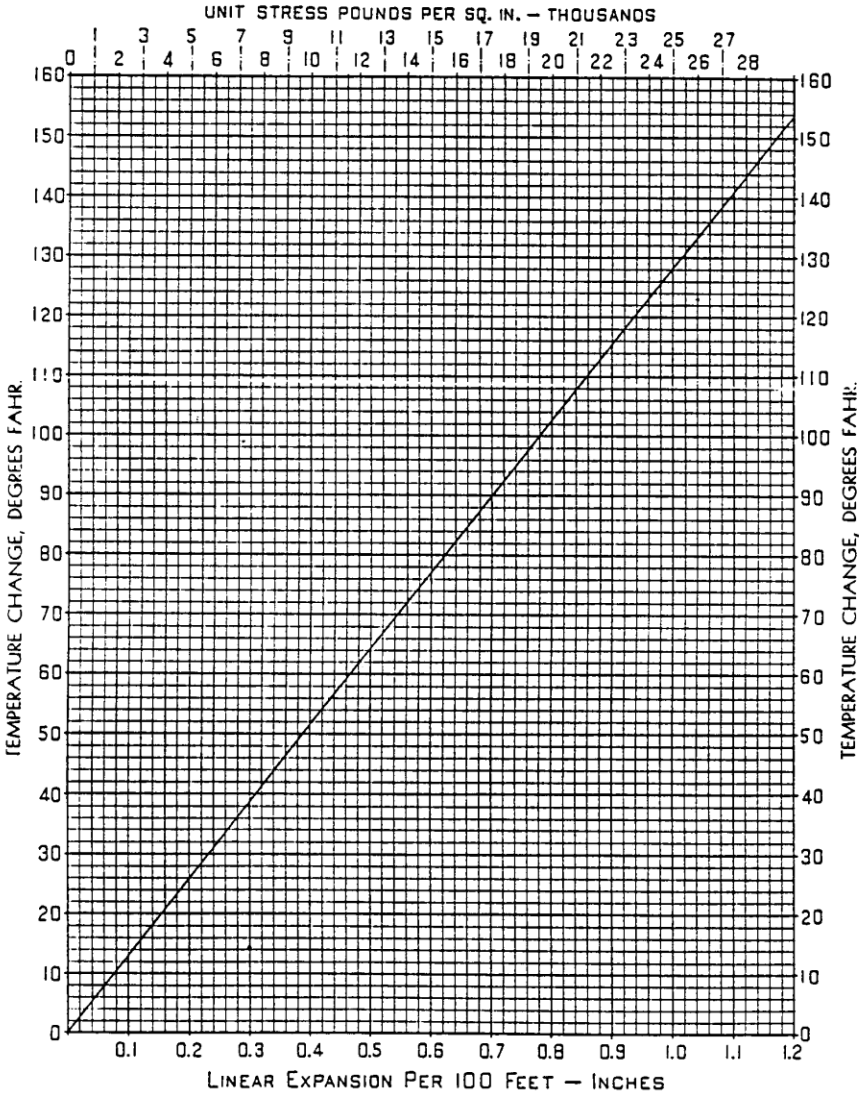
MiSource
Distribution Operations

Gas Standard

Effective Date: 06/01/2012	**Pipeline Flexibility, Supports and Anchors**	Standard Number: **GS 2220.020(CG)** P&P 530-7
Supersedes: 09/28/1987		Page 3 of 3

EXHIBIT A

LINEAR EXPANSION AND STRESS IN STEEL PIPE



Note: The stress is that due to linear expansion or contraction between two anchored points in a pipe line, having no bends.

MiSource
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 1 of 20

Companies Affected:

☐ NIPSCO	☐ CGV	☐ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☐ CPA

REFERENCE Code of Federal Regulations - Title 49 - Part 192
ANSI Z223.1 - National Fuel Gas Code

1. GENERAL

Since pipelines on a rooftop present special accessibility, design and other operating considerations, the installation of a gas pipeline on a rooftop should only be considered when other alternatives are not reasonably feasible.

Rooftop piping plans shall be reviewed with Engineering - Facilities Planning prior to making a commitment to owners.

2. ACCESSIBILITY

The property owner shall provide CDC with permanent 24 hour access to CDC's rooftop facilities. The preferred means of access is an interior stairwell with direct exterior access.

When considering access, thought shall be given to vehicular accessibility, frequency and type of operation and maintenance requirements, and equipment needed to maintain the facilities by Plant and Service personnel.

Since accessibility to the rooftop must be provided, discussion with the owner shall be conducted about installing a walkway or releasing the Company from roof damage. To avoid potential damage to the rooftop, employees shall walk solely on any walkway provided.

3. AGREEMENTS

A Consent-to-Enter Agreement may be required prior to a right-of-way and/or property right agreement. A Consent-to-Enter Agreement, Exhibit A, permits entry for the purpose of constructing and installing gas facilities.

Consideration should be given to the inclusion of the following items in the Consent-to-Enter Agreement:

a. Sketches or drawings showing the approximate location of the facilities to be installed.

b. Sketch to reflect method of rooftop piping support.

c. Provision for release from future liability for damage to roof caused during construction and subsequent operation and maintenance of Company facilities.

d. Provision for reimbursement for unused facilities.

e. Provision for 24 hour access.

A Property Right Agreement, Exhibit B, shall be acquired for CDC's owned rooftop facilities. The agreement shall include all gas pipeline facilities, (mains, service lines, valves, regulators, meter set assemblies and appurtenances.)

A separate Right-of-Way Agreement shall be obtained for CDC's underground piping up to the above ground facilities.

Original copies of Consent-to-Enter and Property Right Agreements shall be filed by Engineering - Land Section.

4. MAIN DESIGN

4.1 Pressure

The MAOP of rooftop piping shall not exceed 60 psig.

4.2 Pipe

Only steel pipe shall be installed for rooftop piping.

The minimum wall thickness for above ground pipe as listed in GS 2100.010(CG) “Design - General" is as follows:

Nominal Pipe Size	1	1-1/4	2	3	4	6
Wall Thickness	0.179	0.191	0.154	0.216	0.237	0.280

Note: Schedule 40 pipe is acceptable.
1" and 1-1/4" are to be used for service line piping only.

4.3 Joining

Mains shall be joined by welding.

4.4 Coating

Exposed pipe shall be black iron pipe cleaned to a near white finish by blast cleaning (SSPC SP-10), primed and painted with an approved paint system. The pipe may also be power tool cleaned (SSPC SP-3), primed and taped with an approved above ground tape. Refer to GS 1420.050 “Coating Methods for Fabricated Stations & Settings” for additional guidance.

4.5 Support

The design of the piping supports should be discussed with the developer prior to installation.

One method of providing rooftop pipe support is by "Pillow Block Pipe Stand." Refer to Material Catalog Groupid M-35.

Another method is by a 4" x 4" x 18" fire retardant, pressure treated wood block placed on top of a 2' x 2' x 2" reinforced concrete pad. It is recommended that a piece of roofing paper or asphalt sheeting be installed between the concrete pad and the building roof and a fiber-glass reinforced spacer be placed between the pipe and wood block.

Both methods of pipe support are illustrated in Exhibit C.

Supports shall allow for the free movement of the exposed piping.

Spacing of supports is recommended as follows:

Nominal Pipe Size	2" and smaller	3"	4"	6"
Support Spacing	10'	12'	14'	17'

4.6 Valves

A valve shall be installed at a distance from the structure sufficient to permit its operation during an emergency that would preclude access to the structure.

An additional valve in the main riser to the rooftop shall be installed.

Both valves shall be designated critical valves and inspected according to GS 1760.010 “Critical Valve Inspection and Maintenance.”

Additional valves may be considered for isolation purposes.

4.7 Flanges

Where valving segmentation of the rooftop piping is required, welded flanges shall be installed. No other fittings, such as unions, are permitted.

Flanges except those on the riser valve shall be electrically bonded with a #12 wire. While all flanges shall be sealed, the riser valve insulated flange shall be sealed in accordance with Standard Drawing No. S-687, Exhibit D.

4.8 Expansion Loops

Exposed steel pipe will expand or contract 3/4"/100°F/100'. Therefore, provisions for expansion should be considered where a straight length of main exceeds 100 feet.

4.9 Grounding/Electrical Isolation

Roof top piping shall be electrically continuous. However, an insulated flange kit shall be installed on the outlet of the riser valve to electrically isolate the buried piping from the rooftop piping. Grounding is provided by a ground cell installed as close to the building as possible (Exhibit E).

4.10 Testing

Testing shall be performed in accordance with GS 1500.010 or GS 1500.010(OH) “Pressure Testing."

4.11 Clearance

Each main shall be installed with enough clearance from any other structure to allow proper maintenance and to protect against damage that might result from proximity to other structures.

4.12 Building Riser Piping

The building riser piping shall be placed in a protected location, such as a building corner, wall recess, or area of minimal exposure to guard against vehicular damage (Exhibit E).

5. SERVICE LINE CONSIDERATIONS

5.1 Tap Connections

The tap connection shall be a welded positive shut off punch tee.

5.2 Service Line Piping

The service line shall:

a. be provided with a shut off (curb) valve where required by a state tariff or regulation.

b. be constructed of pipe in accordance with Section 4.2.

c. be coated in accordance with Section 4.4.

d. be tested in accordance with GS 1500.010 or GS 1500.010(OH) “Pressure Testing."

e. have sufficient clearance from other structures.

If an elbow is required in the riser, it shall be a weld fitting.

5.3 Customer Service Lines

In those states that require by tariff that the customer service line portion be owned and maintained by the customer, arrangements may be made for installation by the Company.

5.4 Meter Set Assembly Placement

The meter set assembly shall be installed according to Form C-2235, "Standards for Customer Owned Service Lines and Meter Set Installations (Plumbers' Guide)," and in addition shall be:

a. installed as close to the main as possible.

b. supported, if required; and

c. incorporate sufficient flexibility for expansion and contraction of the main and house lines. See Exhibit C for typical installations.

6. OPERATIONS

6.1 Marking

The use of pipeline marker decals, Form C-2886, "Caution Gas Pipeline," and Form C-2505-X, "Call Before You Dig Pipeline Marker Sticker," Exhibit F, shall be affixed to provide identification of exposed gas facilities and to reduce the possibility of damage or interference by others. Placement of the pipeline marker decals shall be at the riser valve and should be considered at:

a. changes in direction of the main, such as near the top and bottom of the main riser.

b. valves.

c. flange connections.

d. distances of 150 foot increments.

6.2 Inspection

The following inspections shall be scheduled as a WMS Repetitive Task (RT) and be conducted at intervals not exceeding 15 months, but at least once each calendar year.

The results of inspections shall be reported on the WMS Job Order. A Job Order shall be issued to correct any deficiency.

6.2.1 Supports

Pipe supports shall be visually inspected to identify whether: damage has occurred to the support, roof or pipe and if the pipe is being supported.

When a problem(s) is identified:

a. on Company installed facilities, a Job Order shall be issued to correct the problem.

b. on pipe supports maintained by the building owner, the owner shall be notified of the problem(s) by letter (Exhibit G).

6.2.2 Coating (Paint)

Pipe coating, including paint, shall be inspected to identify areas of disbonding, scratches, or scrapes. Damage to the pipe coating is most likely to occur where the pipe is in contact with the pipe supports. Observe for atmospheric corrosion.

6.2.3 Leakage

The leakage survey shall be performed in accordance with GS 1708.030 "Leakage Survey and Test Methods."

6.3 Remote Indexes

If feasible, the customer shall be encouraged to design for the installation of remote meter reading devices.

7. MAINTENANCE

Damage to coating shall be repaired in accordance with GS 1420.035 “Coating Repair Methods for Mill Applied Coatings” or GS 1420.050 “Coating Methods for Fabricated Stations & Settings.”

Pipe repair shall be done in accordance with GS 1714.020 “Leakage: Distribution Pipe Repair.”

8. HOUSE LINES

The installation and maintenance of house lines is the responsibility of the customer.

The house piping shall be sized, installed, and tested in accordance with Form C-2235, "Standards for Customer Owned Service Lines and Meter Set Installations (Plumbers' Guide)," and the National Fuel Gas Code NFPA 54 (ANSI Z223.1).

Rooftop house lines shall be securely supported. Section 4.5 of this procedure provides information on support. (Refer to ANSI/MSS SP-58-Standard Practice For Pipe Support).

Exposed rooftop house lines shall be protected from corrosion by the application of a painting system specifically designed and manufactured for the protection of steel structures.

The rooftop house lines should have sufficient flexibility to prevent thermal expansion or contraction from causing excessive stresses in the piping material, excessive bending or loads at joints, or undesirable forces or moments at points of connections to equipment and at anchorage or guide points. See Section 4.8.

9. MAPPING

The mapping symbols illustrated in GS 2610.010(CG) "Map Features" shall be used.

Building plans showing the building outline shall be provided with the Designed Job Order Completion Report for inclusion on the operations maps.

MiSource
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 8 of 20

EXHIBIT A
(1 OF 4)

JOB ORDER NO.:_____

CONSENT TO ENTER AGREEMENT

On this __ day of _____, 19 __, the undersigned, ____ _____ Company, Agent for _____ owner of the real property known as the _____, situated in __(city)__ (county) , (state) , in consideration of receiving and accommodating for gas service for the (construction, renovation or expansion) of the said _____ hereby consents to and authorizes Columbia Gas of _____, Inc. (Columbia), its employees or independent contractors to enter upon the above mentioned lands and buildings for the purpose of facilitating timely construction and installation of gas pipelines together with valves, service lines and other appurtenances, including certain of said facilities which will be placed on the rooftop at said property. Said construction and installation of the gas pipeline facilities, as shown on the attachments are for the benefit of both parties and to be located at a mutually agreeable location.

Upon notice by Columbia of completion of said gas pipeline facilities, the owner or Agent for the owner, and Columbia will inspect the rooftop, for damage, within 14 days of said notice. Columbia agrees that Columbia or its contractor will only be responsible for any damage to the rooftop determined to be the result of the intentional or negligent acts or omissions by Columbia or its contractor. Upon inspection and mutual approval by owner, or Agent for owner, and Columbia, the owner will release and hold harmless Columbia from liability for future damages from the initial installation of gas facilities.

MiSource
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
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EXHIBIT A
(2 OF 4)

All gas pipeline facilities (except customer service lines and houselines required by state tariffs to be owned by customer) are to remain the property of Columbia at all times.

If the gas pipeline facilities are installed and not utilized because of the failure of the said property owner to utilize gas as originally contemplated, said owner will reimburse Columbia accordingly.

_____, further agrees to grant and execute an appropriate recordable right-of-way and/or property right agreement, on forms prepared by Columbia, for a total consideration of $1.00, before commencement of said construction and installation of the gas pipeline facilities. Said property right agreement is to include all rooftop facilities and unrestricted 24 hour access to all gas pipeline facilities.

Upon execution of this agreement, Columbia will schedule the installation of the pipeline facilities.

WITNESS:

_____

ACKNOWLEDGED BY:
(Company Name)

By: _____
Authorized Representative

WITNESS:

_____

ACKNOWLEDGED BY:
Columbia Gas of _____, Inc.

By: _____
Authorized Representative

MiSource
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
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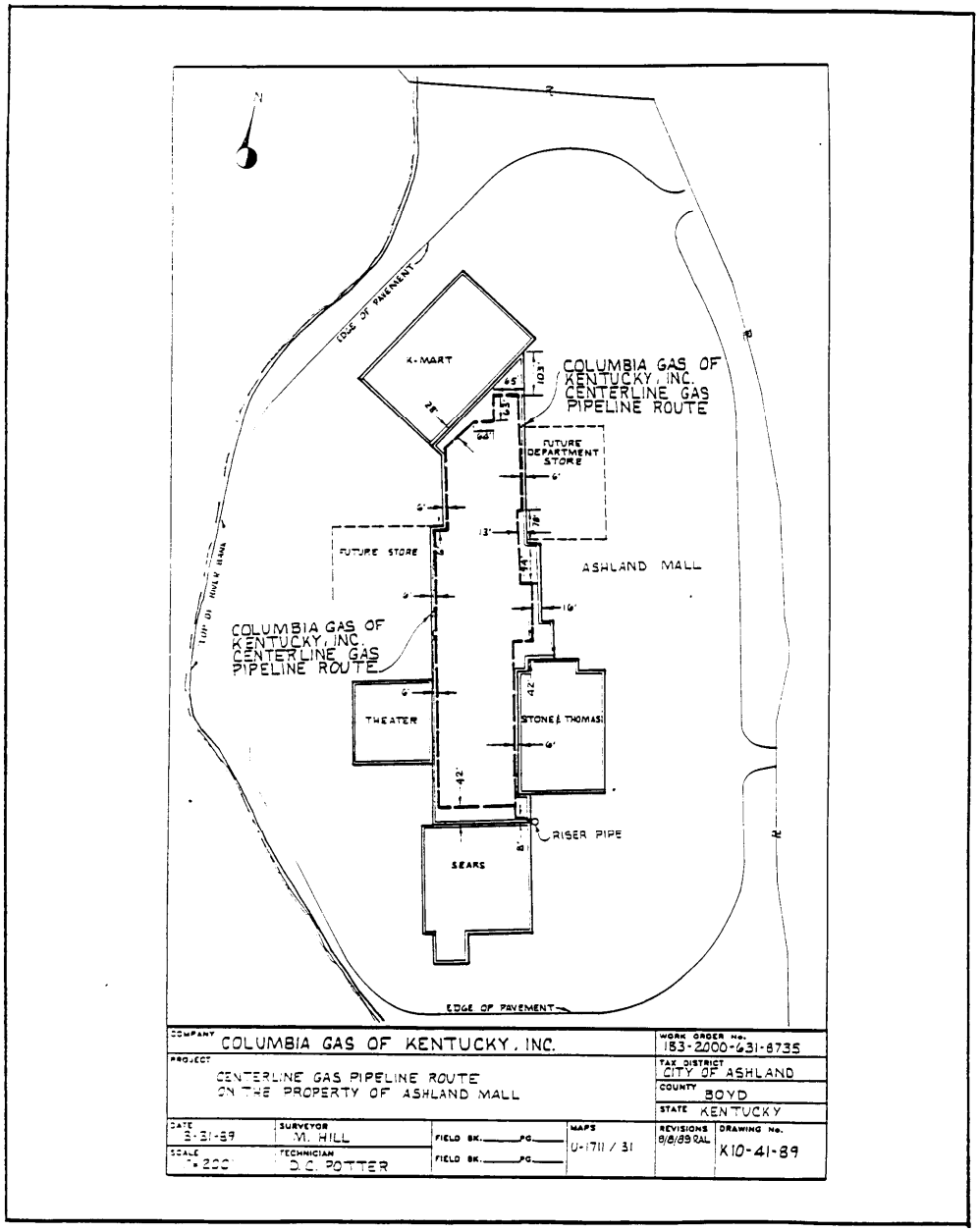
EXHIBIT A
(3 OF 4)



MiSource
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 11 of 20

EXHIBIT A
(4 OF 4)

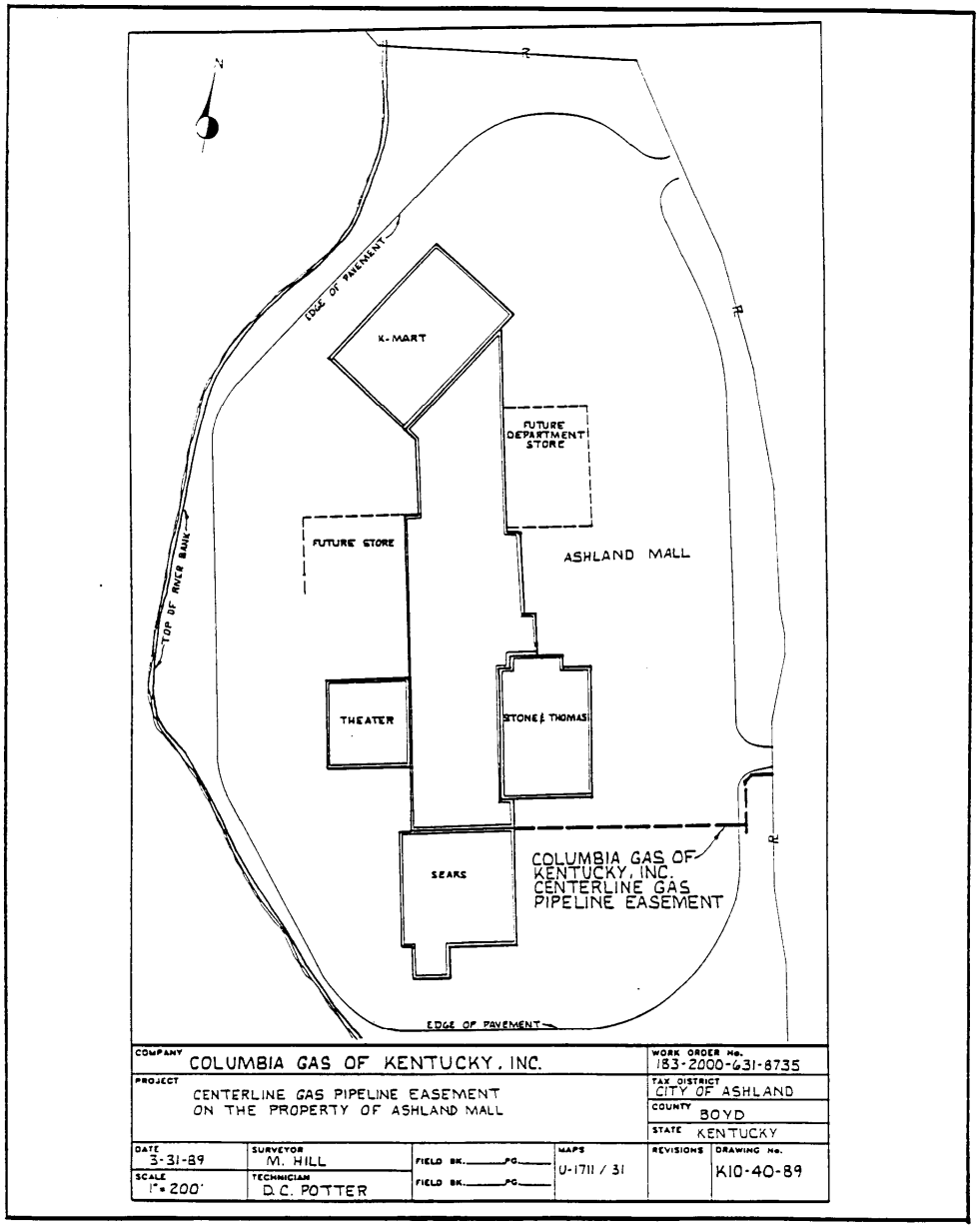


EXHIBIT B
(1 OF 4)

PROPERTY RIGHT AGREEMENT
(Rooftop Gas Facilities)

For and in consideration of One Dollar ($1.00) and other good and valuable consideration to it in hand paid, receipt of which is hereby acknowledged,

_____

_____

_____

hereinafter called Grantor, does hereby grant to Columbia Gas of _____, Inc. with principal offices at 200 Civic Center Drive, P. O. Box 117, Columbus, Ohio 43216-0117 hereinafter called the Grantee, its successors and assigns, the right to construct and install gas pipelines together with valves, service lines and other appurtenances (collectively gas facilities) on the roof and over the structures leading to the roof of the premises hereinafter described, and to operate, maintain without restriction or limitation, repair, replace or change the size of its gas facilities and to remove same on the premises situated in _____, _____ County, ____ and more particularly described as follows:

Grantor shall provide a means of ingress and egress to and from said rooftop facilities including, but not limited to, appropriate stairways, and the like. Said ingress and egress shall be provided on a 24 hour basis. The ingress and egress

EXHIBIT B
(2 OF 4)

may be limited to appropriate walkways or other areas as provided by the Grantor if walkways or areas are expressly defined herein. The Grantor may fully use and enjoy the said premises, except for the purposes herein granted to said Grantee and will not in any way impair the ability of the Grantee to operate, maintain, repair, replace or remove any gas facility.

The Grantor shall not interfere with or place any encumbering structures over or in close proximity to said gas facilities so as to create an operational problem or safety problem. Grantor shall not otherwise undertake or have undertaken by others construction or repair activities that may or will affect said gas facilities without first providing notice to Grantee and affording the Grantee an opportunity to either take protective measures or request that Grantor take necessary steps to protect such gas facilities.

The Grantor shall hold harmless Grantee (Columbia) from and against any and all loss, damage or liability, including environmental liability, and from any and all claims for damages on account of or by reason of bodily injury, including death, which may be sustained or claimed to be sustained by any person, including any employees, Contractors or Subcontractors of Grantor, and from and against any and all damages to property, including loss of use, and including property of Grantee (Columbia), caused by or arising out of an act or omission of Grantor or its agents, employees, Contractors or Subcontractors, in connection with the performance of this contract, or caused by or arising out of or claimed to have been caused by or to have arisen out of the concurrent negligence of Grantee (Columbia), its agents and employees, in connection with the performance of this contract, whether or not insured against; provided, however, that the foregoing indemnification will not

EXHIBIT B
(3 OF 4)

cover loss, damage or liability arising from the sole negligence or willful misconduct of Grantee (Columbia), its agents and employees; and Grantor shall at its own cost and expense defend any claim, suit, action or proceeding, whether groundless or not, which may be commenced against Grantee (Columbia) by reason thereof or in connection therewith, and Grantor shall pay any and all judgments which may be recovered in any such action, claim, proceeding, or suit, and defray any and all expenses, including costs and attorneys' fees, which may be incurred in or by reason of such actions, claims, proceedings, or suits.

To the extent permitted by law, Grantor expressly waives the benefit for itself and all Contractors and Subcontractors, insofar as the indemnification of Grantee (Columbia) is concerned, of the provisions of any applicable workers' compensation law limiting the tort or other liability of any employer on account of injuries to the employer's employees.

IN WITNESS WHEREOF the Grantor hereto has hereunto set its hand this ___ day of _____, 19_.

Signed and acknowledged
in the presence of:

_____ By: _____

_____ By: _____

MiSource
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 15 of 20

EXHIBIT B
(4 OF 4)

STATE OF _____)
) SS:
COUNTY OF _____)

BEFORE ME, a Notary Public in and for said County and State, personally appeared of the aforenamed, _____ who represented that _____ _____ duly authorized in the premises, and who acknowledged that _____ did sign the foregoing instrument, and that the same is ___ free act and deed as such ___ and is the free act and deed of said _____.

IN TESTIMONY WHEREOF, I hereunto set my hand and official seal this __ day of _____, 19_.

My Commission Expires:

_____ _____
Notary Public

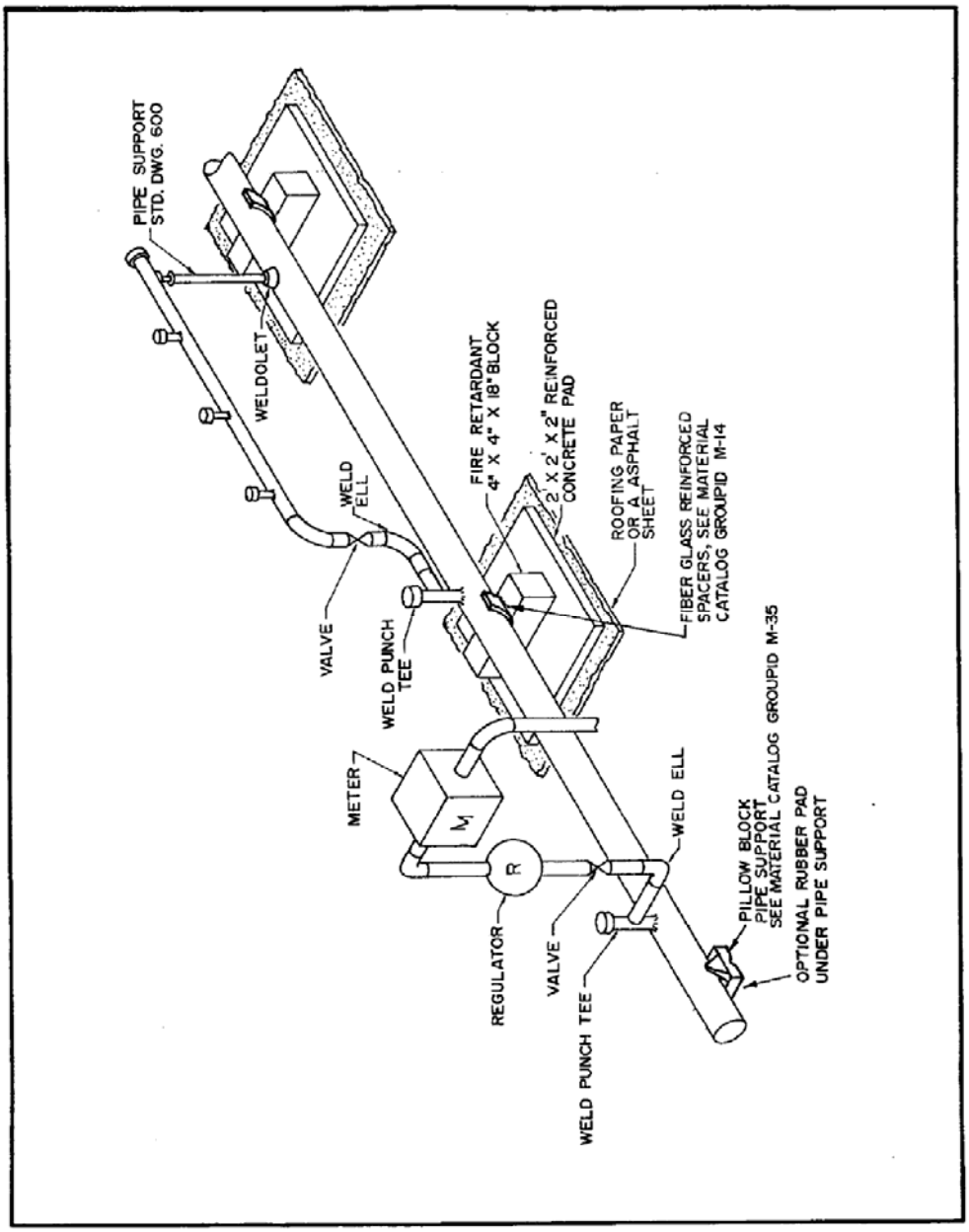
THIS INSTRUMENT PREPARED BY:
COLUMBIA GAS OF _____, INC.

MiSource
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 16 of 20

EXHIBIT C



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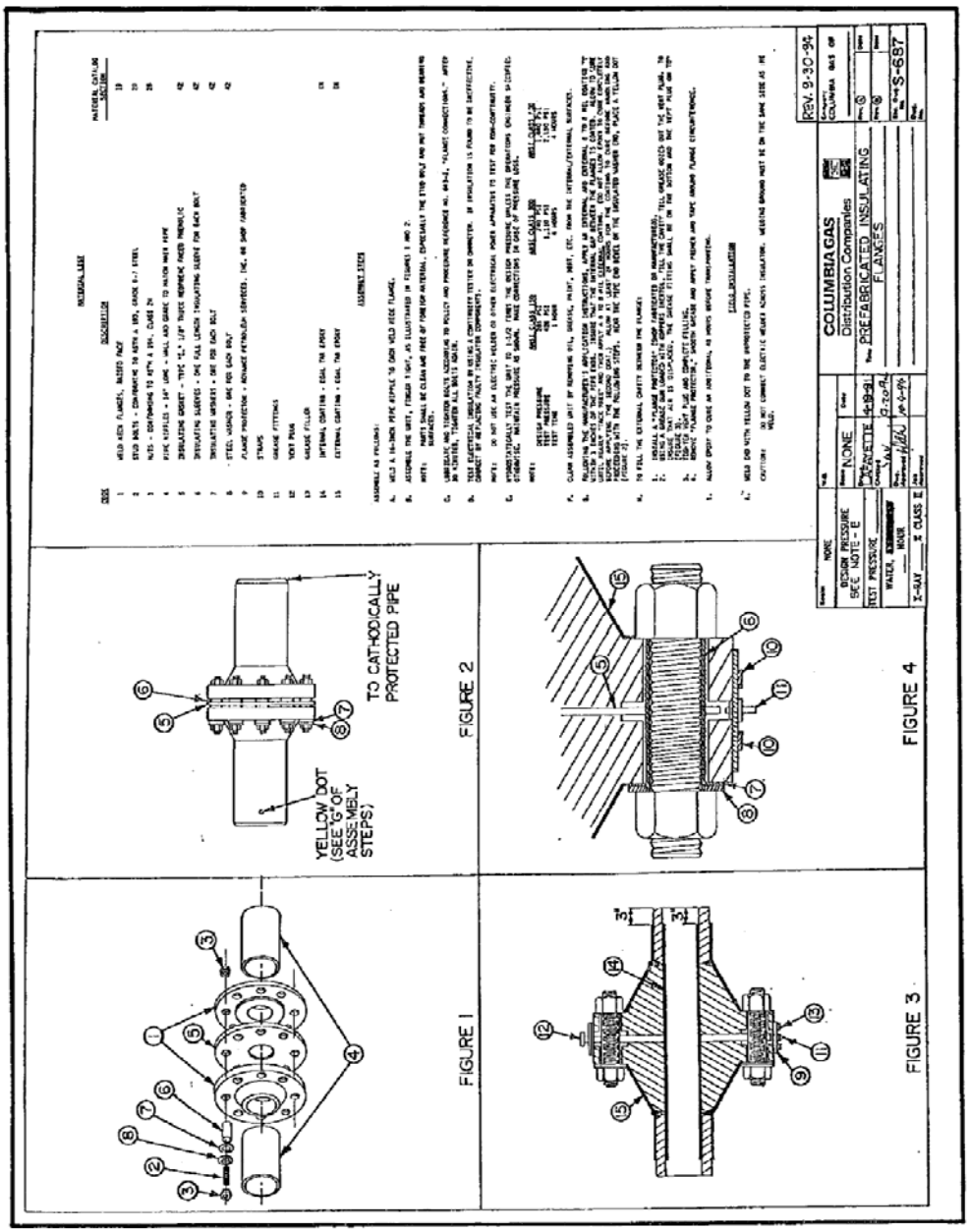
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 17 of 20

EXHIBIT D



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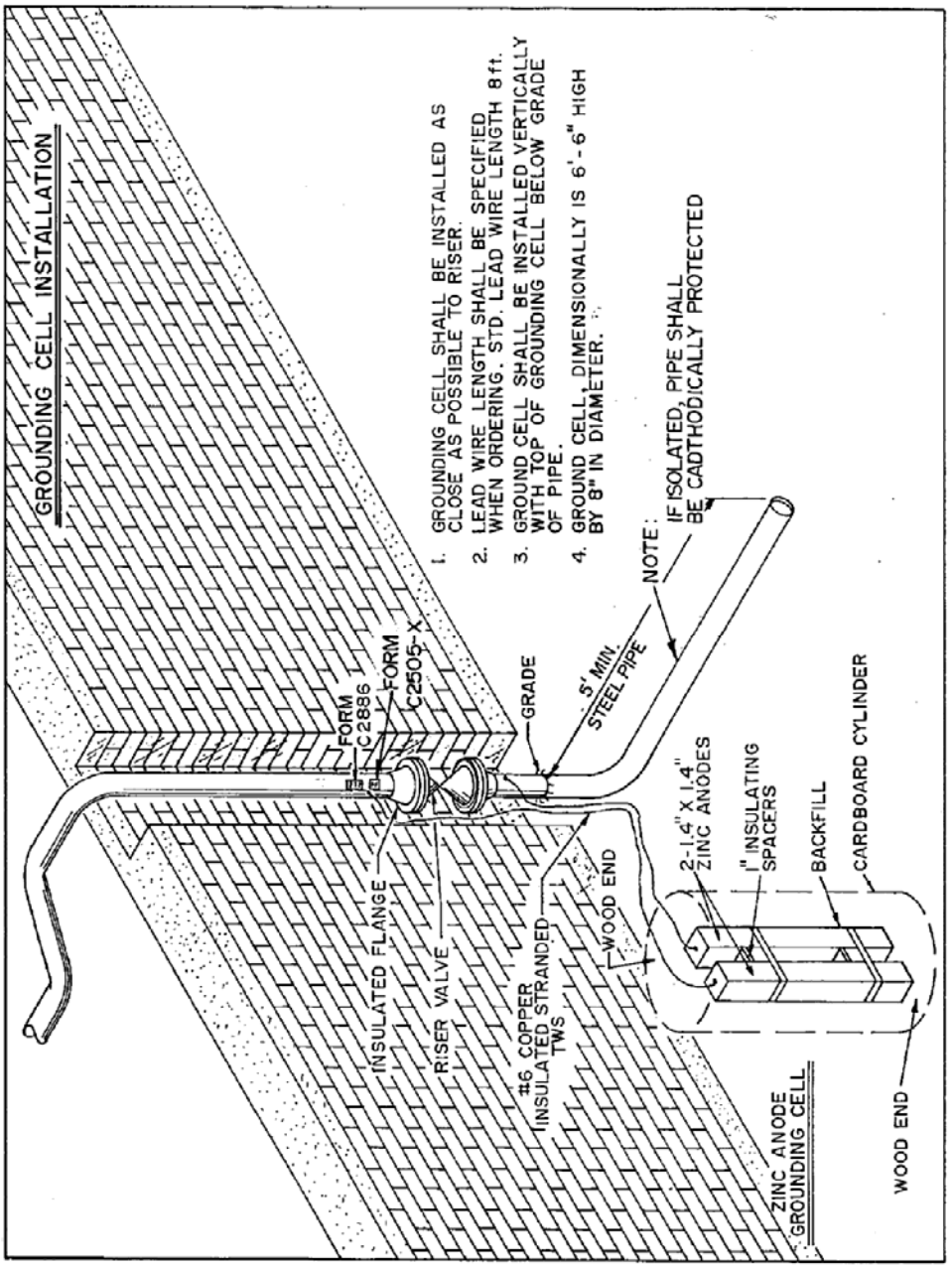
Distribution Operations

Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 18 of 20

EXHIBIT E



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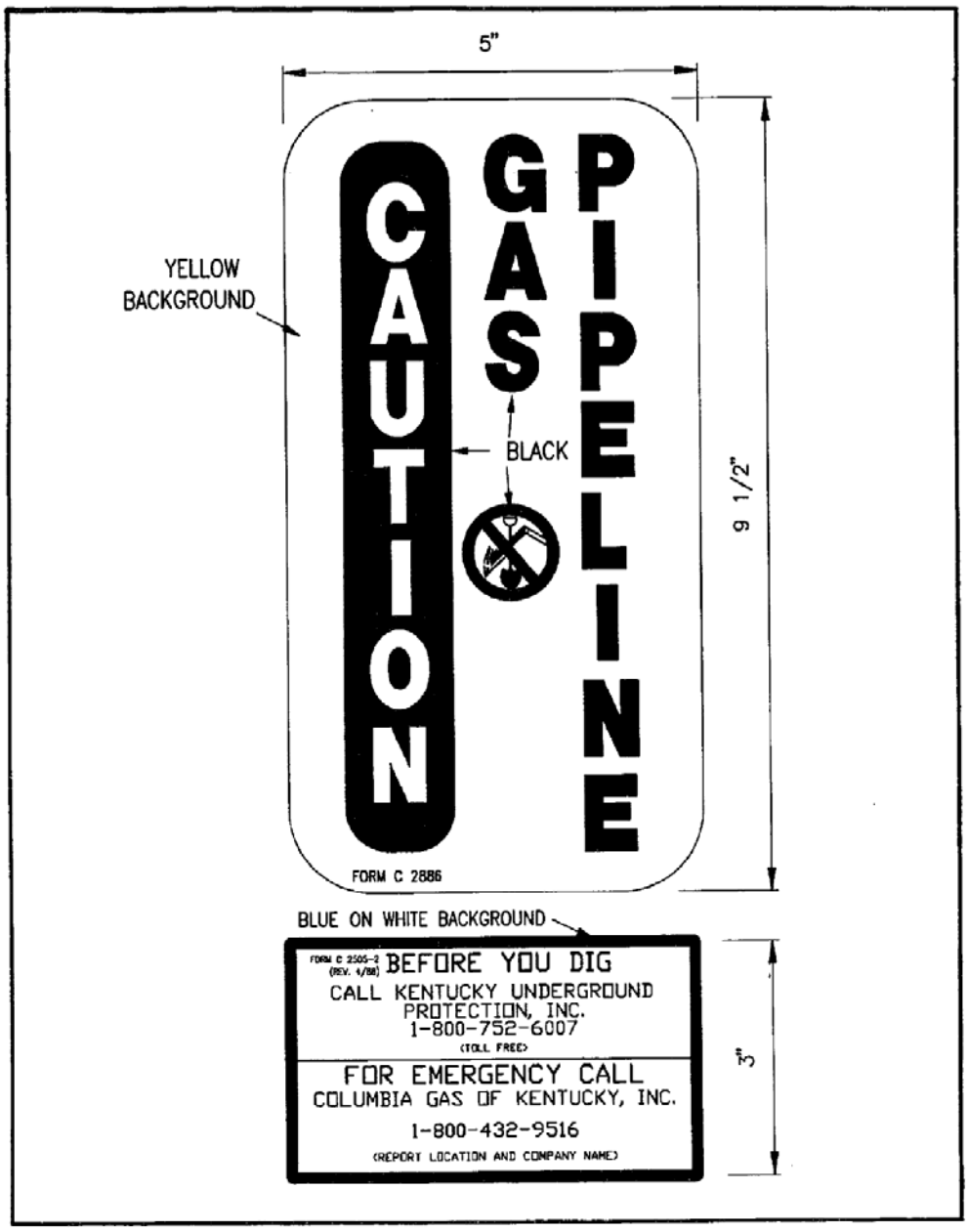
Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 19 of 20

EXHIBIT F



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Gas Standard

Effective Date: 04/09/1996	**Rooftop Piping**	Standard Number: **GS 2260.010(CG)** P&P 535-8
Supersedes: N/A		Page 20 of 20

EXHIBIT G

COLUMBIA GAS
Distribution Companies

Columbia Gas of Kentucky
Columbia Gas of Maryland
Columbia Gas of Ohio
Columbia Gas of Pennsylvania
Commonwealth Gas Services

(Date)

(Shopping Center ID)
(Address)
(City, State, Zip Code)
Attn: (Name of Owner)

Dear (Name of Owner),

During Columbia Gas of (Company Name), Inc.'s routine inspection of its rooftop facilities at (Shopping Center ID), a problem with the pipe supports was identified. In order to avoid damage to your roof and/or Columbia's facilities, prompt remedial action is required.

We (were) (were not) able to discuss this problem with the shopping center agent after conducting the inspection.

Please contact (Name) at (Telephone Number) so this situation may be reviewed.

Sincerely,

Operations Engineer

cc: District Operations Manager

Columbia Gas Distribution Companies, 200 Civic Center Drive, P.O. Box 117, Columbus, Ohio 43216-0117

MiSource
Distribution Operations

Gas Standard

Effective Date: 02/23/1987	**Converting Pipelines to Natural Gas Service**	Standard Number: **GS 2280.010(CG)** P&P 535-7
Supersedes: N/A		Page 1 of 1

Companies Affected:

☐ NIPSCO	☑ CGV	☐ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☐ CPA

REFERENCE Code of Federal Regulations - Title 49 - part 192 - §§ 192.14 and 192.452

A steel pipeline previously used for other than natural gas service not subject to CDC Policies and Procedures can be qualified for use if a written plan is prepared and followed to carry out the following requirements:

a. Conduct a review of the design, construction, operation, and maintenance history of the pipeline. Where sufficient historical records are not available, conduct appropriate tests to determine if the pipeline is in a satisfactory condition for safe operation.

b. Review the pipeline right-of-way for any infringement that may impair the pipeline's serviceability.

c. Conduct a visual inspection for physical defects and operating conditions which reasonably could be expected to impair the strength or tightness of the pipeline of above ground segments and appropriately selected underground segments.

d. Correct known unsafe defects and conditions.

e. Conduct a pressure test in accordance with GS 1500.010 or GS 1500.010(OH) “Pressure Testing” to substantiate the maximum allowable operating pressure permitted by GS 1660.020 “Maximum Allowable Operating Pressure (MAOP)."

f. Implementation of a corrosion control program in accordance with GS 1400.010 “Corrosion Control – General” pertaining to existing pipelines within one year after the pipeline is readied for natural gas service.

Maintain for the life of the pipeline a record of investigations, tests, repairs, replacements, and alterations made to qualify the pipeline for gas service. Attach related documents to Blanket Budget 559 Work Order and retain for the life of the pipeline being converted.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2013	**Providing As-built Drawings for Metering and Regulating Stations**	Standard Number: **GS 2300.005**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE

1. GENERAL

An “as-built” drawing shall be submitted with the completion packet for all regulating and metering stations installed on a design capital work order.

“As-built” drawing is defined to mean an updated design drawing that includes all changes made to the design during fabrication and installation including material specifications and any configuration and/or setting orientation changes made to meet site requirements.

2. RESPONSIBILITY

2.1 Engineering

The project engineer (Gas Systems Design Engineer or Field Engineer) shall make every attempt to provide an accurate design drawing to the field or fabrication shop. Any changes required to a standard design drawing shall be discussed with the M&R Design Group to determine if a revised drawing is needed.

2.2 Fabrication Shop

The fabrication shop shall notify the M&R Design Group if material as specified on the design drawing is not available or requires long lead times. If material substitution is agreed upon the M&R Design Group shall modify the drawing accordingly. When a station is completed the fabrication shop shall indicate on the drawing that the station was built in accordance with the design drawing specifications and include it with the records package when sent to the field operations engineer.

2.3 Project Manager, Inspector or Coordinator

The project manager, field inspector or field coordinator for the project shall be responsible for noting on the drawing any changes made to the design during installation including material specifications and any configuration and/or setting orientation changes made to meet site requirements. When a station is installed the project manager or field inspector shall indicate on the drawing that the station was built in accordance with the design drawing specifications.

3. RECORDS

All “as-built” drawings shall be included in the completion report packet. Each as-built drawing shall have the name, signature and date of the person responsible for the fabrication setting and installation thereof. As-built drawings shall have the name of the project or identifying WMS JO number/Project ID or work order number. Each as-built drawing should be denoted with a page number and/or drawing number on each page.

NiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Regulator Station Design**	Standard Number: **GS 2300.010**
Supersedes: 01/01/2013	**1" Regulators**	Page 1 of 4

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.199

1. GENERAL

This standard provides the design details for 1 inch regulator stations in both a single run and dual run configurations. These designs shall be used for all design pressure requirements up to 720 PSIG. Both designs include an enclosure for security purposes.

2. DESIGN DRAWINGS

Detailed design drawings and bills of material for these 1 inch regulator stations are available on the Standards intranet page. Table 1 lists the details of both configurations by drawing number, description, regulator size, pipe size, design pressure and regulator type.

Table 1

Drawing No.	Description	Regulator Size (inches)	Pipe Size (inches)	Design Pressure (PSIG)	Monitor Regulator	Control Regulator
REG-16	1" Enclosed, Single Run	1	1	720	Fisher 627M	Fisher 627R
REG-16N	1" Enclosed, Single Run	1	1	720	Fisher 627M	Fisher 627
REG-17	1" Enclosed, Dual Run	1	1	720	Fisher 627M	Fisher 627R
REG-17N	1" Enclosed, Dual Run	1	1	720	Fisher 627M	Fisher 627

3. APPLICATION

This station provides pressure regulation for inlet pressure up to 720 PSIG to serve small to medium sized loads.

4. SITE LOCATION

These stations will normally be located on public rights-of-way and should be a safe distance from the road. If needed, grade and stone site in accordance with the guidelines in GS 2300.020 "Regulator Station Design," Section 18.2.

5. DESIGN AND DRAWING REVIEW AND APPROVAL

Design parameters used and preliminary station drawings shall be submitted to the Gas Transmission and M&R Design Group and as appropriate, to Distribution or Transmission Operations, the Corrosion Group, and Technical Support for informational purposes.

6. STATION SIZING

The engineer shall review the station design for proper regulator orifice sizing, and flow velocity following the guidelines below. The piping size is restricted to 1 inch

a. Current regulator sizing programs should be used for determining regulator capacity and flow velocity.

b. Each regulator run has two regulators in a monitor-operator configuration. In the single run design size the regulators for the full capacity needed. The dual run configuration has two identical regulator runs in parallel, one operating run and one standby run, each sized for the full capacity needed from the station.

c. The engineer should use all resources available to insure proper station sizing including Gas Transmission and M&R Design, Gas Planning, Gas Standards, Operations, etc.

7. REGULATOR SELECTION

These stations have been designed using Fisher Series 627 regulators as standard. Use of other regulators is permissible after review and approval by the Gas Transmission and M&R Design Group. See Section 16, "Allowable Design Variations." Regulators selected shall have valve and valve seats that are designed not to stick in a position that will make the device inoperative.

The Fisher 627M is the standard regulator used for the monitor in all designs. The Fisher 627R is the standard regulator used for the controller in the REG-16 and 17 designs and the Fisher 627 is used as the controller in the REG-16N and 17N designs. In addition, the REG 16N and 17N designs use a non-primary relief valve (Fisher 289) in place of the internal relief on the 627R.

Note that the capacity of the 627R can be up to 50% less for some inlet pressure and orifice size combinations and it is limited to a maximum inlet pressure of 300 psig with a 3/8 inch orifice and to 200 psig with a ½ inch orifice. Refer to the manufacturer's literature for capacity, maximum inlet pressure, maximum differential pressure, relief performance and additional information.

8. NON-PRIMARY RELIEF VALVE

The internal relief on the 627R and the Fisher 289 relief valve are not intended to provide full capacity relief, but are designated as non-primary pressure reliefs.

The Fisher 627R regulator has an internal relief with a ¾ inch female pipe thread connection on the diaphragm case. If the 627R regulator is used the preferred installation is to extend a ¾ inch vent pipe to the outside of the cabinet. If a relief stack is not used or permitted by local codes, the 627R regulator shall be installed with the relief vent pointed down on the outside of the enclosure.

All relief vents shall extend a minimum of 7 feet above grade and be attached to a support post. A weather cap shall be installed on the open end of the relief stack piping. A drip leg shall also be installed on the relief stack piping to prevent the accumulation of moisture.

See Section 7, "Supplemental Relief Devices" in GS 2300.020 for design parameters for a full capacity relief device if needed.

9. CONTROL LINES AND BLOWDOWN TAPS

Control line connection size shall be a minimum of ½ inch as specified on the design drawing. Tubing used for control lines shall be stainless steel and a minimum of 3/8 inch in size. Blowdown connection size shall be ¼ inch or ½ inch as specified on the design drawing.

10. PRESSURE TESTING

Required test pressure and duration are stated on the individual design drawings. For additional pressure testing guidance refer to local Company standards (policy and procedures). Before testing remove regulator diaphragm cases and plate body, or remove entire regulator from station piping.

11. VALVES

A valve shall be placed on the inlet of each regulator station at a distance from the regulator station sufficient to permit the operation of the valve during an emergency that might preclude access to the station.

Inlet and/or outlet isolation valves may be placed closer than 25 feet from the station if it will not compromise emergency operation and does not violate state and/or local regulatory requirements which may require more than 25 feet.

12. COATING

Station piping shall be primed and coated with an approved coating system. Piping that will be buried shall be coated with an approved corrosion protection product. Refer to GS 1420.040 "Coating Methods for Girth Welds, Fittings, Risers, & Other Below Grade Appurtenances" for details.

13. PROTECTION REQUIREMENTS

Traffic protection (e.g., concrete filled metal posts or equivalent) should be considered for stations where a possibility of damage from vehicles is anticipated or if required by local regulations or ordinances. If applicable, the design of the traffic protection shall conform to local regulatory requirements. Refer to GS 2300.020 Exhibit A for bollard design details.

14. ENCLOSURES

REG 16 and 17 are designed to fit inside a 12" x 12" x 40" lockable metal enclosure. REG 16N and 17N are designed to fit inside a 12" x 20" x 46" lockable metal enclosure. The back of the enclosure is mounted to a metal or wood support post. The enclosure is designed to allow the entire front and two sides of the enclosure to be removed for servicing.

Use of the enclosure is optional. If not utilized, placement should be such to minimize exposure to public areas.

15. SIGNAGE

Station I.D. signs will be individually ordered for each station.

16. ALLOWABLE DESIGN VARIATIONS

Alternate regulators, appurtenances and configurations can be used if approved by Gas Transmission and M&R Design group.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Regulator Station Design**	Standard Number: **GS 2300.020**
Supersedes: 05/01/2014	**2 Inch and Larger**	Page 1 of 31

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

Bullet g. in Section 17.2 no longer applies (building number/name plate).

Bullet g. will be removed in the next revision release.

(Note Added: 02/01/2016)

REFERENCE 49 CFR Part 192.183, 192.185, 192.187, 192.189, 192.199

1. GENERAL

This standard details the design parameters and allowable variations for compact and standard regulator station designs. Compact stations are limited to two (2) inch regulators (for exception see Section 22.d) and standard stations use two (2), three (3) and four (4) inch regulators. Stations requiring six (6) inch and larger regulators, Point of Delivery (POD) and Exchange stations will be designed individually by the Gas Transmission and M&R Design Group.

This standard applies to new installations and rebuilds of existing installations.

2. DESIGN DRAWINGS

Detailed design drawings and bills of material for two (2) inch compact and two (2), three (3) and four (4) inch standard regulator stations are available on the Standards intranet page. Table 1 lists all available compact and standard regulator stations designs by drawing number, description, regulator size, pipe size, design pressure and regulator type.

3. SITE LOCATION

3.1 Aboveground

a. If the station is to be located on private land, the lot size purchased should be of a size to provide for adequate working space, easy access and an area for off road vehicle parking and any future expansion (i.e. water bath heater, filter, etc.)

b. If the station is to be located on public rights-of-way, it should be a safe distance from the road, have adequate truck parking nearby, and be protected on all sides by guard posts, if necessary. See Section 15.2 “Protection Requirements.”

3.2 Below ground

a. Away from street intersections and paved areas where traffic is heavy or dense.

b. Away from points of minimum elevation, catch basins or places where access doors or covers of the installation will be subject to the entrance of surface water.

c. So as not to conflict with other underground utilities or other subsurface installations.

d. Where there will be ample space to park vehicles while work or maintenance is being performed.

e. Away from or off the vehicular traveled way. (i.e. tree belt, traffic islands or medians, etc.).

Table 1

Drawing No.	Description	Regulator Size (inches)	Pipe Size (inches)	Design Pressure (PSIG)	Regulation
Compact Regulator Stations					
REG-1	Monitor-Operator, Parallel Run, with Enclosure	2	2 x 4	275*	Sensus 461/441
REG-2		2	2 x 4	275	Dresser REDQ or Mooney Flowgrid
REG-3		2	2 x 4	720	
Standard Regulator Stations					
REG-4	Monitor-Operator, Parallel Run	2	2 x 4	275*	Sensus 461/441
REG-5		3	3 x 6	275*	
REG-6		4	4 x 8	275*	
REG-7		2	2 x 4	275	Dresser REDQ or Mooney Flowgrid
REG-8		3	3 x 6	275	
REG-9		4	4 x 8	275	
REG-10		2	2 x 4	720	
REG-11		3	3 x 6	720	
REG-12		4	4 x 8	720	
REG-13		2	2 x 4	720	Sensus 461/441
REG-14		3	3 x 6	720	
REG-15		4	4 x 8	720	

* Stations designed with ANSI Class 125 Sensus 461 or 441 regulators will be limited a 175 PSIG or less inlet pressure depending on the model installed, but the station pipe is to be tested for a 275 PSIG design pressure. See Section 10 “Pressure Testing.”

Table 1 (continued)

Drawing No.	Description	Regulator Size (inches)	Pipe Size (inches)	Design Pressure (PSIG)	Regulation
Standard Regulator Stations (continued)					
REG-22	Monitor-Operator, Parallel Run, Skid Mounted	2	2 x 4	275*	Sensus 461/441
REG-23		3	3 x 6	275*	
REG-24		4	4 X 8	275*	
REG-25		2	2 x 4	275	Dresser REDQ or Mooney Flowgrid
REG-26		3	3 x 6	275	
REG-27		4	4 X 8	275	
REG-28		2	2 x 4	720	
REG-29		3	3 x 6	720	
REG-30		4	4 X 8	720	
REG-31		2	2 x 4	720	Sensus 461/441
REG-32		3	3 x 6	720	
REG-33		4	4 X 8	720	
REG-34	Monitor-Operator, Parallel Run, Below Ground Vault	2	4	275	Dresser REDQ or Mooney Flowgrid
REG-35		4	4	275	
REG-36		6	6	275	
REG-37		2	4	720	
REG-38		4	4	720	
REG-39		6	6	720	

* Stations designed with ANSI Class 125 Sensus 461 or 441 regulators will be limited a 175 PSIG or less inlet pressure depending on the model installed, but the station pipe is to be tested for a 275 PSIG design pressure. See Section 10 “Pressure Testing”.

4. DESIGN AND DRAWING REVIEW AND APPROVAL

Design parameters used and preliminary station drawings shall be submitted to the Gas Transmission and M&R Design Group and as appropriate, to Distribution or Transmission Operations, the Corrosion Group, and Technical Support for informational purposes.

All regulator station design deviations beyond those allowed in Section 20 “Allowable Design Variations,” shall be approved by the Gas Transmission and M&R Design Group. All station designs shall be submitted for approval through the normal channels.

5. STATION SIZING

The engineer shall review the station design for proper pipe and regulator sizing, and flow velocity following the guidelines below.

a. Current regulator sizing programs should be used for determining regulator capacity, inlet/outlet pipe sizes and flow velocity. Above ground flow velocity should be a maximum of 60 fps (40 mph) in residential areas and 100 fps (68 mph) in industrial and outlying areas.

b. All station designs have two identical regulator runs in parallel, one operating run and one standby run. Each regulator run is sized for the full capacity needed from the station.

c. Proper sizing of a regulator station to match system needs is critical for proper operation and regulator performance. Minimum system inlet pressure should be taken into considered when sizing all stations.

d. The engineer should use all resources available to insure proper station sizing including Gas Transmission and M&R Design, Gas Planning, Gas Standards, Operations, etc.

6. REGULATOR SELECTION

For pilot applications, the Dresser REDQ (formerly the Grove TE) and Mooney Flowgrid are the only regulators approved for use. For low differential applications Mooney FloMax regulators are approved. For self-operated (spring-loaded) applications the Sensus 441 & 461 regulators (formerly Rockwell) are the only regulators approved for use. For operational considerations, it is recommended that Dresser REDQ and Mooney Flowgrid regulators not be mixed in the same station. A self-operated (spring-loaded) monitor regulator with a pilot loaded operator regulator may be used in each run to help protect against failures from gas quality issues or if capacity and pressure fluctuations require. Regulators selected shall have valve and valve seats that are designed not to stick in a position that will make the device inoperative. Use of a regulator other than those listed above shall be reviewed and approved by the Gas Transmission and M&R Design group.

Self-operated (spring-loaded) regulators are preferred when:

a. outlet pressure is 75 psig or less,

b. outlet pressure fluctuations of 2-3 psig above and below the set point are acceptable or,

c. gas quality issues (such as hydrocarbons or pipeline liquids) might cause operational problems.

Pilot operated regulators are preferred when:

a. outlet pressures are greater than 75 psig,

b. outlet pressure fluctuations of 2-3 psig above and below the set point are not acceptable or,

c. station is pit type design (pilot loaded regulators are preferred for ease of maintenance and accessibility).

The Dresser REDQ and Mooney Flowgrid are interchangeable, however, in some large capacity situations or for certain differential requirements the following should be considered.

a. Dresser REDQ provides easier maintenance under space constraints, such as, pits or enclosures.

b. Mooney Flowgrid provides greater capacity at low differentials. (When differential across regulator run is less that 60 PSIG and Mooney model 20 pilot is used, consult Mooney operation and maintenance manual for alternate control line tap placement for improved performance.)

c. Mooney Flowgrid provides for higher capacity requirements (larger sizes).

d. Dresser REDQ and Mooney Flowgrid are suitable for use as relief valves.

6.1 Pilot Regulators and Filters

The Mooney model 20 pilot regulator is approved and recommended for use with both approved pilot regulators.

A filter is required on all pilot regulators. The Welker F5 and Mooney type 30 pilot filters are approved for this purpose. The Mooney type 30 pilot filter shall only be used on stations that are not expected to have problems with liquids.

6.2 Pilot Regulator Heaters

The use of insulation or catalytic heaters is recommended on all pilot regulators and control lines where there is potential for freezing.

If gas quality is expected to be a problem at a station consideration should be given to installing catalytic or flow (vortex) type pilot heaters. Catalytic heaters are normally used. Flow style (Vortex) heaters are not suitable for low flow conditions (less than five (5) mcfh) but may be considered on constant flowing stations since they do not use gas and are extremely low maintenance. Vortex Heaters require a 1.3/1 pressure ratio to function properly.

7. SUPPLEMENTAL RELIEF DEVICES

Relief devices may be considered for retention as a non-primary overpressure protection device when planning to rebuild or modify an existing regulator station, where applicable and/or on new and existing small distribution systems serving less than 100 customers. The following design criteria shall be followed when a relief device is installed to fully protect a system from over pressurization.

a. The relief valve and valve seats shall be designed not to stick in a position that will make the device inoperative.

b. The equipment shall be designed and installed so that it can be operated to determine the valve is free, can be tested to determine the pressure at which it will operate and can be tested for leakage when in the closed position.

c. The vent stack designed to prevent the accumulation of water, ice or snow and be located where gas can be discharged into the atmosphere without undue hazard.

d. The pipe and fittings between the relief device and the system to be protected is adequately sized to prevent hammering of the relief valve and to prevent impairment of the relief capacity.

e. Where installed at a district regulator station to protect a pipeline system from over pressuring be designed and installed to prevent any single incident such as an explosion in a vault or damage by a vehicle from affecting the operation of both the overpressure protection device and the district regulator(s).

f. The position of a valve under a relief valve shall be secured to prevent the relief valve from becoming inoperative.

8. CONTROL LINES AND BLOWDOWN TAPS

A minimum of ½ inch diameter opening shall be used for control line and blowdown (purge) taps. Control line and blowdown taps shall be installed as specified in the bill of materials on the design drawings. Each control line and blowdown tap shall have a shutoff valve as near as practicable to the point of takeoff.

Blowdown taps shall be located on station piping before and after all regulators, and on pipe sections where pressure can be bottled-up, for purposes of purging and relieving pressure during maintenance procedures.

Tubing used for control lines shall be stainless steel and a minimum of 3/8 inch in size. Larger sizes of tubing or pipe may be used when longer control line runs are required. The standard location for all control line taps is above grade on the outlet leg of the station piping downstream of the outlet valve. If it is necessary to locate taps below grade, coated steel pipe shall be used for the buried portion.

Additional taps are permissible when needed for gauges, pressure monitoring, etc.

9. STATION BLOWDOWN RISERS

Station blowdown risers used to isolate and blowdown the station piping may be installed as necessary.

10. PRESSURE TESTING

Required test pressure and duration are stated on the individual design drawings. For additional pressure testing guidance refer to local Company standards (policy and procedures). Class 150 stations have a 275 PSIG design pressure and shall be tested at a minimum of 413 PSIG. Class 300 stations have a design pressure of 720 PSIG and shall be tested at a minimum 1080 PSIG. Before testing remove regulator diaphragm cases and plate body, or remove entire regulator from station piping and install blind flanges or a spool piece.

When ANSI Class 125 Sensus 441 or 461 regulators with 175 PSIG maximum working pressure are used, the station piping shall still be tested for a 275 design pressure (413 PSIG minimum test pressure) to allow for the possible substitution of a Mooney Flowgrid or Dresser REDQ regulator in the future.

11. INSPECTION OF WELDS

All welds shall be inspected per the local company welding manual. In addition, if the design pressure will produce a hoop stress on the station piping of 20% or more of its Specified Minimum Yield Strength (SMYS) nondestructively test all welds up to the outlet valve(s). Refer to GS 1210.010 “Nondestructive Testing” for specific requirements.

12. VALVES

Reduced port ball valves are standard in all stations designs and are specified on the bill of materials. Full port ball valves may be substituted if necessary for capacity reasons.

A valve shall be placed on the inlet of each regulator station at a distance from the regulator station sufficient to permit the operation of the valve during an emergency that might preclude access to the station.

Inlet and/or outlet isolation valves may be placed closer than 25 feet from the station if it will not compromise emergency operation and does not violate state and/or local regulatory requirements which may require more than 25 feet.

Consideration should be given to installing at least 10 feet of welded steel on the inlet and outlet of the station to provide support. Where sufficient distance cannot be achieved an alternate method of supporting the setting shall be provided.

13. PRESSURE RECORDING AND TELEMETERING

The installation of pressure recording gauges shall be considered when planning to rebuild or modify an existing regulator station or when constructing a new regulator station.

13.1 Distribution Systems Supplied by More Than One Regulator Station

On distribution systems supplied by more than one regulator station, telemetering or recording pressure gauges shall be installed at points on the system that will best indicate an abnormal operating condition. Such points may include but are not limited to, the inlet and/or outlets of regulator stations feeding the system, or a suspected low pressure point.

13.2 Distribution Systems Supplied by One Regulator Station or Supplied Directly from a Source not Requiring Regulation

On distribution systems supplied by one regulator station or supplied directly from a source not requiring regulation, the need for the installation of telemetering or pressure recording gauges shall be determined by the Field Engineering group. Consideration will also be given to the number of customers on the system, operating pressure, size and capacity of the system, location of other recording gauges, and the following.

a. Recognition of pressure excursions and response time of the operating personnel to the regulator station.

b. The magnitude of the pressure excursion or an abnormal operating condition which would indicate a regulator failure. (e.g., minimum and maximum operating pressures, established alarm point for telemetered signals.)

c. Design parameters of the telemetering system to properly respond to the criteria established in (b) above.

d. Recognition of possible failures if telemetry or recording gauges are not installed.

e. Seasonal changes in normal pressure or flow requirements, which may require resetting the alarm limits.

In Pennsylvania only, at least one pressure recording gauge is required to be maintained and operated in every low pressure system regardless of the number of regulator stations supplying the system.

13.3 Telemetering

Telemetering devices should be considered where continuous or frequent monitoring or adjustment of pressure is necessary to assure the adequate delivery of natural gas.

14. FILTERS AND FILTER-SEPARATORS

A filter or filter-separator may be installed in the inlet piping of a station where known or probable gas cleaning will be required. The project engineer should consult with field operations to determine this need. A filter or filter-separator may not need to be installed at a POD if one is provided by the pipeline company.

15. COATING

Station piping shall be primed and coated with an approved coating system.

16. SECURITY AND PROTECTION

16.1 Security Requirements

The engineer should consult with operations to determine what level of security is needed for a particular location. Station security options include a lockable enclosure, building, fencing, or disabling control and inlet/outlet valves by locking and/or handle removal. Disabling valves is the least desirable option and is generally used as an additional measure rather than sole protection. Lighting should be placed as appropriate. The Security Department may also be consulted to provide recommendations for a specific site. See sections 17 and 18 for specifics on enclosures, buildings and fencing.

16.2 Protection Requirements

Traffic protection (e.g., concrete filled metal posts or equivalent) should be considered for stations where a possibility of damage from vehicles (including company-owned) is anticipated or if required by local regulations or ordinances. If applicable, the design of the traffic protection shall conform to state or local regulatory requirements whichever are more strict. The preferred type of protection is one or more bollards, which are lengths of steel pipe set vertically in concrete. See Exhibit A for design details.

17. ENCLOSURES AND BUILDINGS

17.1 Enclosures

The compact stations, drawings number REG-1, REG-2 and REG-3, are designed to fit inside an 8 foot x 6 foot x 3 foot steel lockable enclosure. The enclosure is designed with full open doors on the front and back sides to provide for easy access for maintenance. This enclosure is available from Crown E.S.A. Inc. in Portage Indiana.

Other enclosure types may be used subject to local approval.

17.2 Buildings

No specific building type is recommended. The engineer should consult with operations to determine building type and specifications. The following guidelines should be followed.

a. Electrical equipment and the installation thereof shall conform to current National Electric Code requirements based on the electrical classification, as defined by Engineering, for said facilities.

b. Four (4) feet minimum spacing between station piping and inside building walls.

c. Two (2) means for egress/ingress should be provided.

d. Place station I.D. signs on the outside walls at each point of entry as a minimum.

e. "No Trespassing" signs should be placed at each potential point of entry.

f. Venting in compliance with AGA XF0277, "Classification of Gas Utility Areas for Electrical Installations".

g. For NGD companies, building identification numbers and name plates should be requested from the Engineering – Capital Close-Out group. The following information is required, taxing, district, job order number, map number and use.

Bullet g. in Section 17.2 no longer applies (building number/name plate).

Bullet g. will be removed in the next revision release.

17.3 Vault and Pit Design Requirements

A pit is an underground structure with full-opening doors for entry with a depth of four (4) foot or greater. A vault is an underground structure accessed through a limited means of access such as a man-hole regardless of depth. Structural design and accessibility of a vault or pit shall meet the following requirements.

a. Structure must be able to meet the load requirements which may be imposed on it and to protect the installed equipment.

b. Working space shall be provided around piping and equipment to allow for proper installation and maintenance activities.

c. All piping and control lines shall be steel. Where piping extends through a wall, it must be installed in a manner that minimizes strain and the annular space around the pipe shall be sealed to prevent the passage of gases or liquids.

d. The location must be accessible and as far away as practical from street intersections and areas of heavy traffic, low areas where water may accumulate, and other utility lines, such as, water, electric and steam.

17.4 Vault and Pit Sealing and Ventilation

Vaults or closed top pits shall be sealed, vented or ventilated as follows.

a. A vault or closed top pit with an internal volume larger than 200 cubic feet shall be ventilated with a minimum of two ducts each having the ventilating effect of a pipe four (4) inch in diameter to minimize the formation of a combustible atmosphere in the vault. The ducts shall be vented to a safe location above ground outside of the structure with their outlets extending high enough above grade to disperse any gas-air mixture that may be discharged. The outside end of the ducts should be equipped with a suitable weatherproof fitting or vent-head designed to prevent foreign matter from entering or obstructing the duct. The horizontal section of the ducts should be as short as practical and pitched to prevent the accumulation of liquids. Where two ducts are employed, it may be desirable to locate one internal vent at a higher elevation than the other for improved ventilation.

b. A vault or closed top pit with an internal volume of more than 75 cubic feet, but less than 200 cubic feet shall be sealed, vented, ventilated in accordance with the following:

    1. If sealed, each opening must have a tight fitting cover without holes through which an explosive mixture might be ignited and there must be a means for testing the internal atmosphere before removing the cover.

    2. If vented, there must a means of preventing external sources of ignition from reaching the vault or pit atmosphere.

    3. A vault or closed top pit of this size may be ventilated as described in 17.4 (a) or by openings in the covers or gratings provided the ratio of the internal volume, in cubic feet, to the effective ventilated area of the cover or grating, in square feet, is less than 20 to 1. If the ratio is higher, additional ventilation is required.

17.5 Vault and Pit Drainage and Waterproofing

a. Shall be designed to minimize the entrance of water

b. May not be connected to any other underground structure by means of a drain connection.

c. Electrical equipment in vaults and pits must conform to the applicable requirements of Class 1, Group D of the National Electrical Code, ANSI/NFPA70.

17.6 Vault and Pit Specifications

Vaults and Pits shall meet the requirements of Sections 17.3 through 17.5 of this

standard. Standard vault designs, shown in design drawings REG-34 through 39, have a volumetric content of less than 200 cubic feet. Vaults with a volumetric content of 200 cubic feet require additional periodic maintenance (see GS 1762.010, "Maintenance of Vaults and Pits") and are not recommended. Consult the Gas Transmission and M&R Design Group for alternatives.

Underground vaults and pits shall be constructed of 5,000 pound concrete mix with rebar per the following specifications:

a. 5,000 PSI rated at 28 Day Strength.

b. Cement: Type III, High-Early strength with admixtures.

c. Air Entrainment at +/- 6%.

d. Rebar: # 5 Bar at 8 inches each way in walls and floor. # 5 Bar at 6 inches each way in top section, #5 crowfeet at corners of hatch, 2-layers.

e. Strength Rated for ASTM H-20 Loading.

A minimum of eight (8) inch wall and floor thickness is recommended. Due to the size of the vaults, three (3) sections are recommended for ease of installation. A rubber gasket material should be utilized for sealing purposes between each section. Access holes for piping and/or conduit can be incorporated into the formation of the vault or cored at a later date. Link Seals or a comparable sealing material should be utilized for all penetrations. A sump hole, at a depth not to exceed 30% of the floor thickness, should be installed in a corner of the vault. An aluminum door with safety ladder and post is recommended for vault coverings.

18. FENCING AND STONE

18.1 Fencing

To provide security, compact or standard size stations may be fenced, in lieu of using an enclosure or building. The following fencing specifications shall be followed.

a. Unless aesthetics is a concern seven (7) feet high galvanized chain link fence shall be used.

b. Fence shall be 10 gage minimum, two (2) inch by two (2) inch square.

c. Fence shall have three (3) strands of barbed wire canted outward unless directly on the property line.

d. Privacy slats may be use at the discretion of local supervision or if required by local codes.

e. Four feet minimum spacing between station piping and fence shall be provided (three (3) feet minimum for security).

f. Two means for egress/ingress should be considered.

g. No Trespassing signs on each face with a minimum of one sign per 100 feet.

h. Place station I.D. signs at each entry point as a minimum (using current standards.)

i. Local authorities should be consulted prior to installing new fences, and local codes should be followed when more stringent.

18.2 Stone

Station sites shall be graded and stoned according to the following.

a. Install landscape fabric under stone base for weed control.

b. Minimum six (6) inch depth of stone recommended (base layer of #2 with #53 on top is recommended).

c. Compact and stone any driving/parking areas.

d. Provide wrap (e.g., rock shield) on risers in stone.

19. CONCRETE PADS, COLUMNS AND RISER SUPPORTS

Concrete pads, columns and riser supports shall be specified by the engineer as needed to provide proper support for all station piping and equipment. See Exhibit B for minimum recommended specifications for station piping support structures.

20. SIGNAGE

Station I.D. signs will be individually ordered for each station. Minimum placement will at each point of entry (using current standards).

'No Trespassing' signs should be placed at each potential point of entry on a fenced station.

See GS 1770.010 "Prevention of Accidental Ignition" for additional signage that may be required.

21. ADDITIONAL DESIGN CONSIDERATIONS

See Exhibit C for additional information on noise abatement, and internal and external freezing of station piping and equipment.

22. ALLOWABLE DESIGN VARIATIONS

The following design variations are allowable at the discretion of the engineer without additional approval.

a. The buried inlet and outlet piping may be connected to either side of the buried station riser header.

b. Gauges, charts and remote monitoring equipment may be added as required.

c. Secondary over pressure warning devices may be added on outlet elbow or the underground outlet piping.

d. Three (3) inch regulators may be substituted in the compact design (drawings REG-1, REG-2, Reg-3) if necessary for capacity reasons. Note that a compact design with three (3) inch regulators will not fit in the standard 96 inch wide x 78 inch high enclosure.

e. Dual parallel regulator run design is standard. For non-critical loads of 20,000 SCFH or less, the regulators in the standby run may be omitted and blind flanges installed on the riser valves. Examples of critical loads are care facilities and non-interruptible process loads.

f. Slip flanges are allowed.

g. Alternate regulators, appurtenances and configurations can be used if approved by Gas Transmission and M&R Design Group.

EXHIBIT A
(1 OF 2)

Bollard Design Details

Typical bollard design consists of a length of concrete filled steel pipe set vertically in the ground in concrete. The table below details the suggested sizing of bollards based on the pipe size to be protected.

Size of Piping to be Protected	Recommended Size of Bollard
¾" – 1 1/4"	2"
2" – 6"	4"
8" – 12"	6"
16" >	8"

Each bollard shall be placed in a concrete filled hole, typically four foot deep, or at a minimum, below the frost line. The size of the hole should be twice the diameter of the bollard. The concrete shall be sloped away from the bollard at grade level. The bollard itself shall be filled with concrete and domed off at the top. The bollard shall extend above grade a sufficient distance to offer adequate protection to the station piping, typically 3'– 4'. Each bollard placed within the station fence, shall be painted yellow. See Figure 1 for details.

Typical spacing of bollards around station piping is at 5 foot intervals or closer depending on the piping configuration being protected. Bollards should be placed an adequate distance from the protected piping to allow ease of access for maintenance and/or repairs.

Customer installed bollards shall conform to the requirements of this standard.

The actual location, placement, and number of bollards required will vary by location and shall be determined by Field Engineering, with input from Construction & Operations.

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Gas Standard

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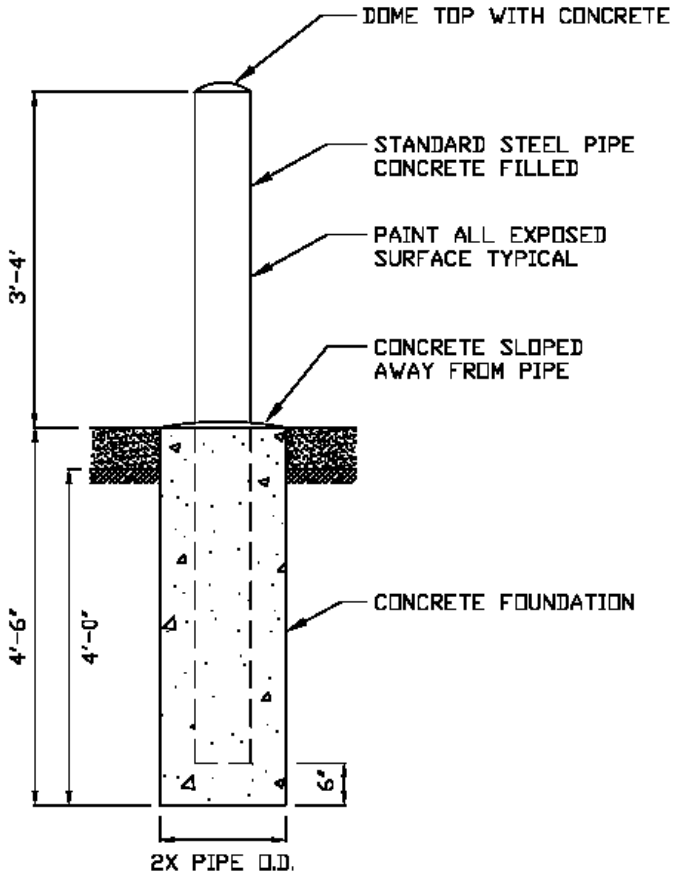

FIGURE 1
BOLLARD DETAIL

EXHIBIT B
(1 of 3)

Concrete Pad, Column and Riser Support Details

1. Concrete Pad
    a. Concrete pads when required for a customer meter or regulator station shall be provided by the customer.
    b. Pads shall be 6 inches thick reinforced concrete. The preferred type of reinforcement is ¼ inch rebar 6 inch on center, or 3/8 inch rebar 12 inch on center, placed 3 inches above the bottom of the pad. If desired, welded wire fabric, 6 inch x 6 inch or 3-1/2 inch x 3-1/2 inch, may be substitute for the steel reinforcing bar. Coated rebar or wire fabric is preferred. Welding on rebar to connect is prohibited.
    c. Base preparation for pad shall be 12 inch compacted sand or crushed limestone on undisturbed earth. Additional base preparation may be dictated by local soil conditions.
    d. All exposed concrete surfaces shall be a float finished and steel troweled to produce a smooth, uniform surface.
    e. All exposed edges shall be finished.
    f. Size of the pad to be determined by local engineer.
    g. Concrete shall be poured a minimum of 7 days prior to use to allow for curing.

2. Concrete Column
    a. Concrete columns shall be a minimum of 12 inches in diameter and 4 feet in length. The top of the column shall extend a minimum of 2 inches above finished grade. See Figure 1 for details.
    b. Reinforcement (rebar or wire) is only needed if top of column will extend more than 2 inches above finished grade.
    c. Sonotube® forms are typically used when pouring concrete columns.
    d. Top edge of column shall be finished.
    e. Concrete shall be poured a minimum of 7 days prior to use to allow for curing.

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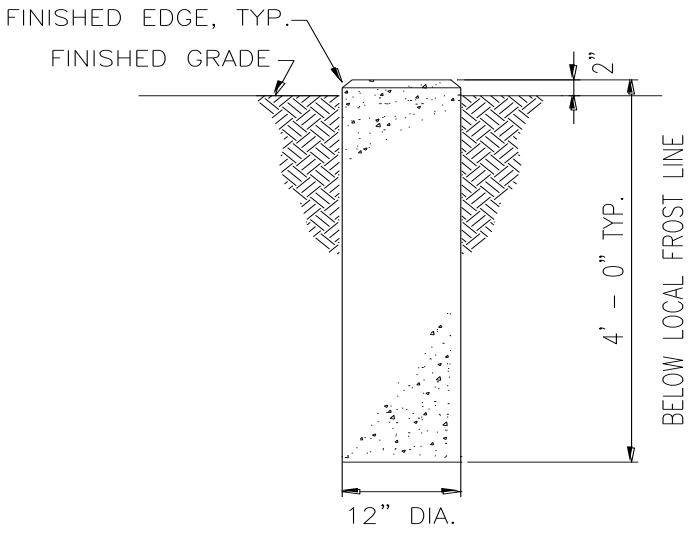

Figure 1

Concrete Column Typical Dimensions

3. Concrete Riser Support:
    a. Typical riser support dimensions are shown in Figure 2. Consult with local engineering for any variance that is required.
    b. Base shall be 12 inch compacted sand or crush limestone. Refer to typical soil conditions in area.
    c. Riser support to have a rough finish.
    d. Reinforcement (rebar or wire) is not needed for riser supports.

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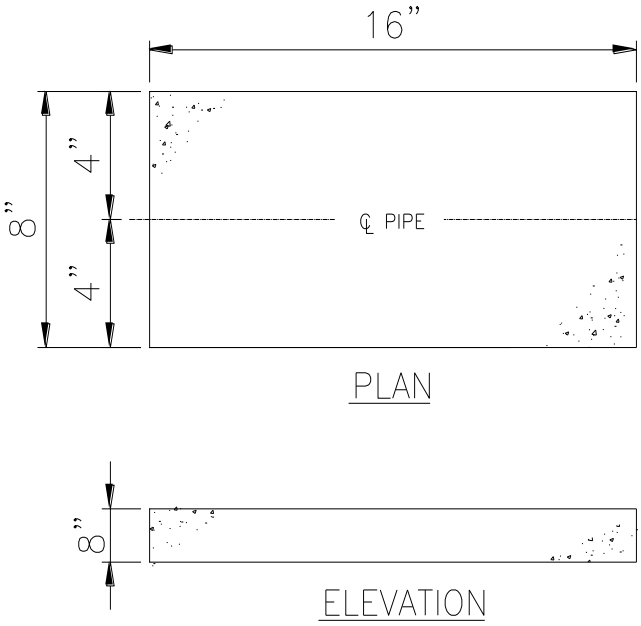

Figure 2

Concrete Riser Support Typical Dimensions

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ADDITIONAL DESIGN CONSIDERATIONS

1. NOISE ABATEMENT

1.1 General

Noise problems at a regulator station may cause employee discomfort and/or environmental or sound pollution.

The solution of one does not necessarily solve the other. Employee comfort in a regulator station with an 85 decibel or higher noise level will normally be satisfied by the wearing of approved hearing protective devices.

Environmental or sound pollution noise is far more difficult to resolve. The source of the noise is dependent upon many conditions which will vary with flow and pressure differential conditions. Normal sources of noise at a regulator station are caused by the configuration of regulators and station piping.

When a noise problem exists, the Gas Transmission M&R Design group may be contacted for guidance.

1.2 Noise Reduction

The selection of regulators and the design of station piping for new stations can prevent the initial introduction of noise.

For existing stations the following remedial practices have been found to rectify some regulator noise problems:

a. Repairing or replacing worn and loose regulator parts or repacking and tightening the stuffing box.

b. By installation of regulators equipped with attenuation trim, i.e.: whisper trim, boot type regulators.

c. Changing the type of inner valve to change the natural frequency. Often, solid throttle plugs are substituted for V-port, or solid V-pup for skirt type V-pup valves.

d. Using reduced inner valve trim in over-sized regulator bodies.

NOTE: Gas Transmission M&R Design group should be consulted prior to implementing this remedial measure to determine whether the

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regulators should be replaced with different style regulators that operate at reduced decibel levels.

e. Rotating noisy V-pup valves 45 to 90 degrees.

1.3 Noise Abatement Consideration

Noise abatement consists of absorption, reflection or dissipation of the noise rather than treating its cause.

Sound-proofed buildings have proved successful for abating noise. This has been accomplished by using hollow concrete blocks in the walls, painting masonry walls, application of transite on studs with metal lath and plaster, increasing the wall thickness, and by installation of various commercial sound absorbent flame retardant materials.

Noise has also been abated by the installation of sound absorbent material around piping. For exposed piping, the absorbent material must have an air-tight and waterproof covering to retain its effectiveness. This has the disadvantage of making maintenance more difficult. Moisture from condensation or leakage not only encourages rusting, but will void the effectiveness of the insulating material. Insulation of buried piping has the additional advantage of inhibiting ground freezing; however, it must be kept waterproof.

1.4 Other Considerations

Although noise is considered a problem, it should be remembered that noise emanating from a system is an indication of the system's operation, and can indicate the necessity for repair and maintenance. The proper balance between too much noise and an acceptable noise level has to be established prior to determining the best method for reducing the noise level.

2. INTERNAL AND EXTERNAL FREEZING

2.1 Gas Hydrates

Natural gas hydrates are solids which are a chemical combination of hydrocarbons and water and can form at elevated pressures and possibly at temperatures considerably above the normal freezing point of water (up to 70° F).

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Normally the gas encountered in distribution systems is dry and has had the higher hydrocarbons removed; however, natural gas taken from local production or storage may have free water and higher hydrocarbons which, with the right combination of pressure and temperature, can cause hydrate formations.

2.2 Cooling Effects

The expansion of gas as the result of a reduction of pressure through a gas regulator produces a cooling effect. As a general rule the cooling effect will be approximately 1º F per 15 psi pressure cut.

2.3 Related Problems

Gas hydrates and cooling effects form the basis for related problems at a regulator station. Freezing problems are classified as either internal or external. Internal problems are gas hydrate blockage and/or ice formation blockage. External problems are ice build-up on regulators and piping above ground and/or formation of ice around lines below ground causing heaving of piping and buildings.

2.4 Internal Freezing

To analyze a regulator and setting for the possibility of internal freezing, it is necessary to investigate the pressure and temperature conditions upstream and downstream and also to consider intermediate conditions at the regulator inner valve.

Since internal freezing will not occur without the presence of free moisture, the first step in determining the probability of ice and hydrate formation in a gas is to determine the gas dew point. Once the dew point has been established the water content of the gas may be found from a water vapor content curve, Exhibit D. If the water content exceeds the saturation value for the gas at any point in the gas stream, and if the temperature and pressure conditions are favorable to ice or hydrate formation, corrective measures shall be taken. Examples of corrective action are given below.

a. Dehydration can reduce the water content of the gas. This reduction can be effected by cooling or chemical means. Dehydration is usually best accomplished by the gas supplier.

b. Methanol and glycol are effective inhibitors that help prevent hydrate and ice formation when injected into the gas stream, but their use is limited due

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to expense. The fact that they cannot be economically recovered, adds to the expense. Both may be used to advantage, however, where freezing problems are relatively mild or infrequent, the addition of these inhibitors to a gas will eliminate ice and hydrate formation by lowering the freezing point. Methanol or glycol injection is not to be undertaken without the approval of the Gas Transmission and M&R Design group.

d. Normal freezing or hydrate formation conditions can be eliminated by the application of heat. Heat may be applied by catalytic or water bath heaters.

e. A catalytic heater is used to prevent internal freezing of regulators or meters. It does not add sufficient heat to the gas stream to prevent pipeline heaving. See Section 2.5 of this Exhibit for guidance to prevent pipeline heaving. Catalytic heaters are normally installed on high pressure cut regulator installations or M&R stations where wet gas conditions exist. Catalytic heaters are normally installed in one of two configurations:

    1. One or two catalytic heating elements mounted in enclosures that cover the regulator or meter body. This is the preferred method for heat transfer. When using catalytic heaters in this way, heat build-up during low flow conditions can cause damage plastic parts and orifice on the regulator body and case. The heat level should be adjusted accordingly and consideration should be given to the use of high temperature regulator seats.

    2. Larger, totally enclosed rectangular “twin pack” heaters, mounted on 3 inch or larger pipe, normally between regulators. This method is best used when minimal heat requirements will resolve the problem. Additional length between regulators may be needed to accommodate the heater enclosure. Optionally, the heater can also be placed on the inlet side of the regulators. If any changes are needed to a standard regulator station design, consult with the Gas Transmission and M&R Design Group.

Exhibit E illustrates typical examples of the two types of catalytic heater installations. The preferred method for heat transfer is by application of heat directly to the regulator body.

Where conditions or space permits, catalytic heating elements should be installed in an enclosure or housing. Heater enclosures for both types are used to increase heat transfer efficiency; they are made of stainless steel to

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reduce maintenance requirements. Catalytic heating elements which are enclosure transfer 50% more heat to the surface than un-housed heating elements. Heater enclosures also provide weather protection for outside installations.

Gas used in catalytic heater operations shall be accounted for on Form C-2377, “Estimate of Unmeasured Gas Used for Regulator Operations” in accordance with applicable procedures (Applies to NGD Companies only).

To provide operational flexibility and to reduce fuel consumption during summer operations, a “Fuel Turn Down” valve should be incorporated on all new catalytic heater installations. The “Fuel Turn Down” valve is sized according to the BTU rating of the heater. On existing heaters with dual heating elements, fuel consumption can be reduced by turning of the fuel shut-off valve to one heating element during periods of low demand.

Installation, starting, and maintenance instructions for catalytic heaters are found in the Heater “Inspection Manual” available through HS&E Technical Training.

f. Water bath heaters that heat the actual gas stream may be used for large volume regulator stations. The required heat capacity of the heater can be determined from the formula:

   BTU/hr = 1.75 x pressure drop (psi) x flow rate (MCFH)

   Installation of water bath heaters shall receive approval of the Gas Transmission and M&R Design group

g. The input of heat has been found to be effective; but periodic checks should be performed to ensure that a heat build-up condition is not present. Over-heating of station piping and/or gas stream can cause regulator valve seats and O-rings to deteriorate.

h. Various other methods of preventing internal freezing have been used.

One method that has been successfully used to prevent regulator freezing consists of reversing the bodies of double-ported regulators. The success of this method is due to the fact that the outlet chamber of a regulator is larger than the inlet chamber and, therefore, affords more contact area between gas and metal. In the normal installation the cold outlet gas tends to determine the regulator temperature. When the valve body is reversed the relatively warm upstream gas tends to determine the regulator temperature.

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A caution must be voiced, however, where transient dirt particles may be encountered in the gas. The greater velocities and angles of deflection accompanying gas flow through the inlet cavity of the regulator body will increase any tendency toward body and inner valve erosion.

Internal freezing of outside piping may occur in either above-ground piping or piping with inadequate cover. Buried piping should be below the frost line. Relief from freezing in above-ground piping can be obtained through the use of wind breakers and insulation.

Coalescing filters, pressure drop piping loops, drips or perk tanks are other methods of preventing internal freezing problems.

2.5 External Freezing

Whenever the temperature of the outlet gas is at or below 32°F, moisture condensed from the air may freeze on the regulator and outlet piping. Moisture in the ground surrounding the pipe may also freeze, causing expansion and heaving of the soil. This heaving action may cause damage to building foundations, highways, railroads, etc., and may impose high stresses and distortion on piping and regulator settings.

To determine whether or not ground freezing may occur, it is necessary to determine if the outlet temperature of the gas is at or below 32°F. The outlet temperature may be approximated from the relationship mentioned previously (i.e., 1°F per 15 psi pressure cut).

Methods that have been used to minimize adverse effects of external freezing at regulator stations include the following.

a. Allowing for the proper drainage of water away from underground piping by surrounding the pipe with at least two feet of loose gravel. Care should be taken to see that drainage is provided for the gravel to keep free water away from the pipelines, and that the gravel used for this purpose has no corrosive properties. The pipe can also be installed in a well-drained gutter or pit to a point beyond that where soil expansion and heaving would be detrimental.

   In some situations removal of the existing soil and replacement with an impervious material, which prevents ground water mitigation, around the piping may be considered.

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In a location which is flat and low, without opportunity for drainage, the regulator setting and piping may be elevated above ground. The outlet piping is extended for some distance from the station before going underground. This distance should be sufficient to insure that ground heaving will not occur close enough to structures to cause structural damage. The distance may, however, be limited by roads, railroads, buildings and other physical property limits. In such case, it may be necessary to install an expansion loop in the outlet piping of regulator stations to absorb pipe movements caused by soil expansion. An expansion loop is especially desirable where considerable stress is expected. Care must be exercised in the installation to see that the expansion loop is not secured to its supports in such a manner as to restrict relief movement.

In addressing the advisability of elevating the piping above ground in a certain location, consideration should be given to the following factors:

1. elevated piping tends to be noisy.
2. exposed piping is more susceptible to internal ice and hydrate.
3. formation than buried piping.

b. The pipe can be insulated to reduce the transfer of heat from earth to pipe to retard freezing of the surrounding earth. Generally the pipe would be insulated in the immediate vicinity of probable points of damage, such as under structure walls, railroads, highways, etc. to prevent ground heaving at these critical points. Methods of insulation include the installation of a sealed casing on the pipe and coating of the pipe-line. The insulating value of sealed casing can be increased by use of low heat transfer fillers. In all cases if the insulation is to retain its effectiveness it must be kept water-tight. Cellular-type materials such as foam glass or foamed-in-place synthetics are preferred for insulating pipelines. Fibrous-type insulating materials should be avoided as they readily absorb water.

c. If none of the above methods are advisable, some method of heating the gas may be used to prevent freezing difficulties as described in Section 2.4.c.

The amount of heat required to maintain the temperature of the outlet gas at some temperature above 32°F can be determined from Exhibit F.

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After heating requirements are determined, heating equipment will be specified by the Gas Transmission and M&R Design group. In most instances, an indirect type of water bath heater will be specified. Selecting and sizing of heating equipment will take into account such factors as boiler limitations, heater efficiency, heat exchanging transfer efficiencies, and ambient temperature effects. Consideration will also be given to possible heat losses between the heat exchangers and downstream regulation.

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Gas Standard

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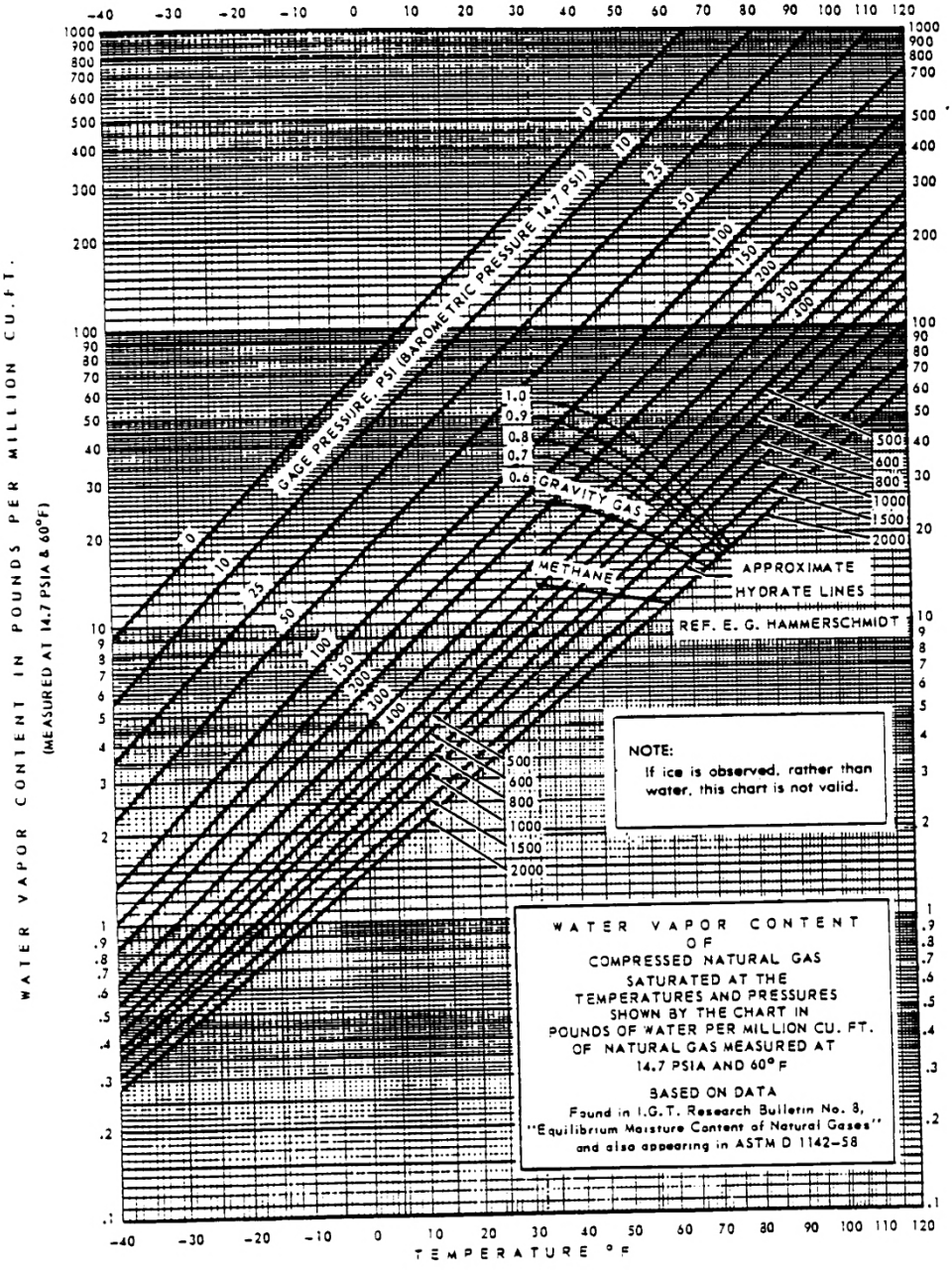
EXHIBIT D



WATER VAPOR CONTENT OF COMPRESSED NATURAL GAS

MiSource
Distribution Operations

Gas Standard

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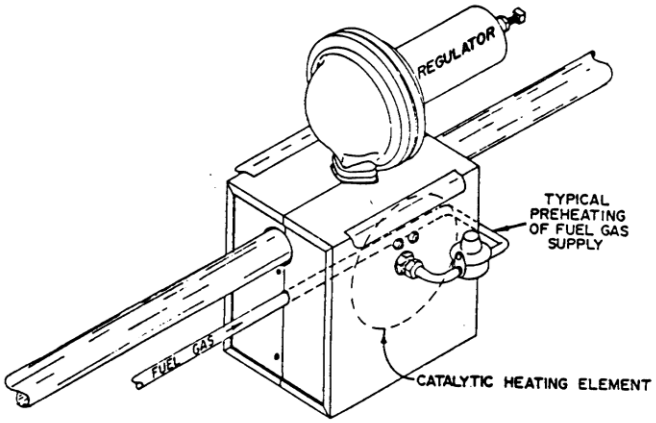
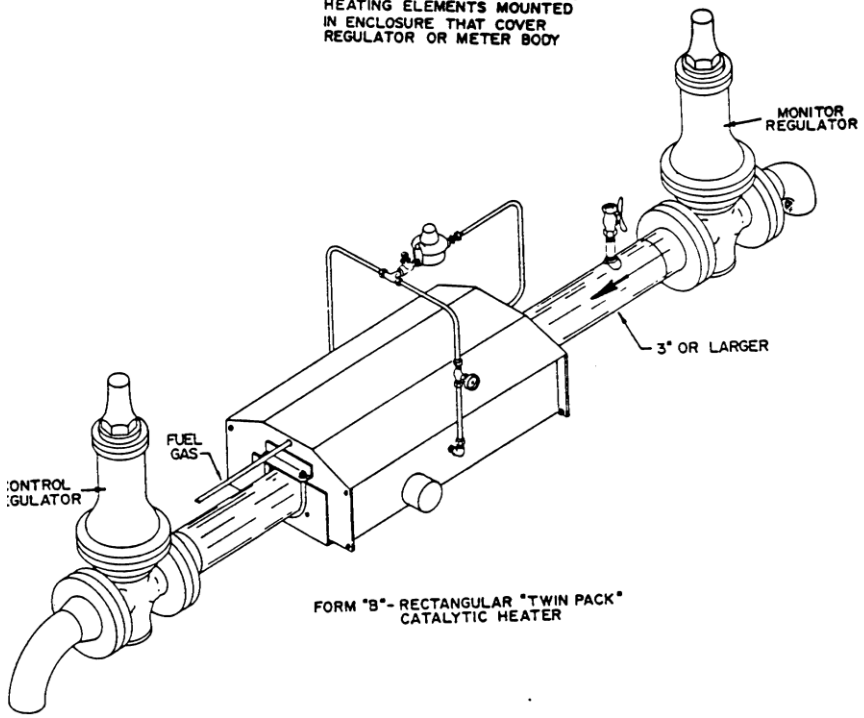
EXHIBIT E



FORM "A" - ONE OR TWO ROUND CATALYTIC HEATING ELEMENTS MOUNTED IN ENCLOSURE THAT COVER REGULATOR OR METER BODY



FORM "B" - RECTANGULAR "TWIN PACK" CATALYTIC HEATER

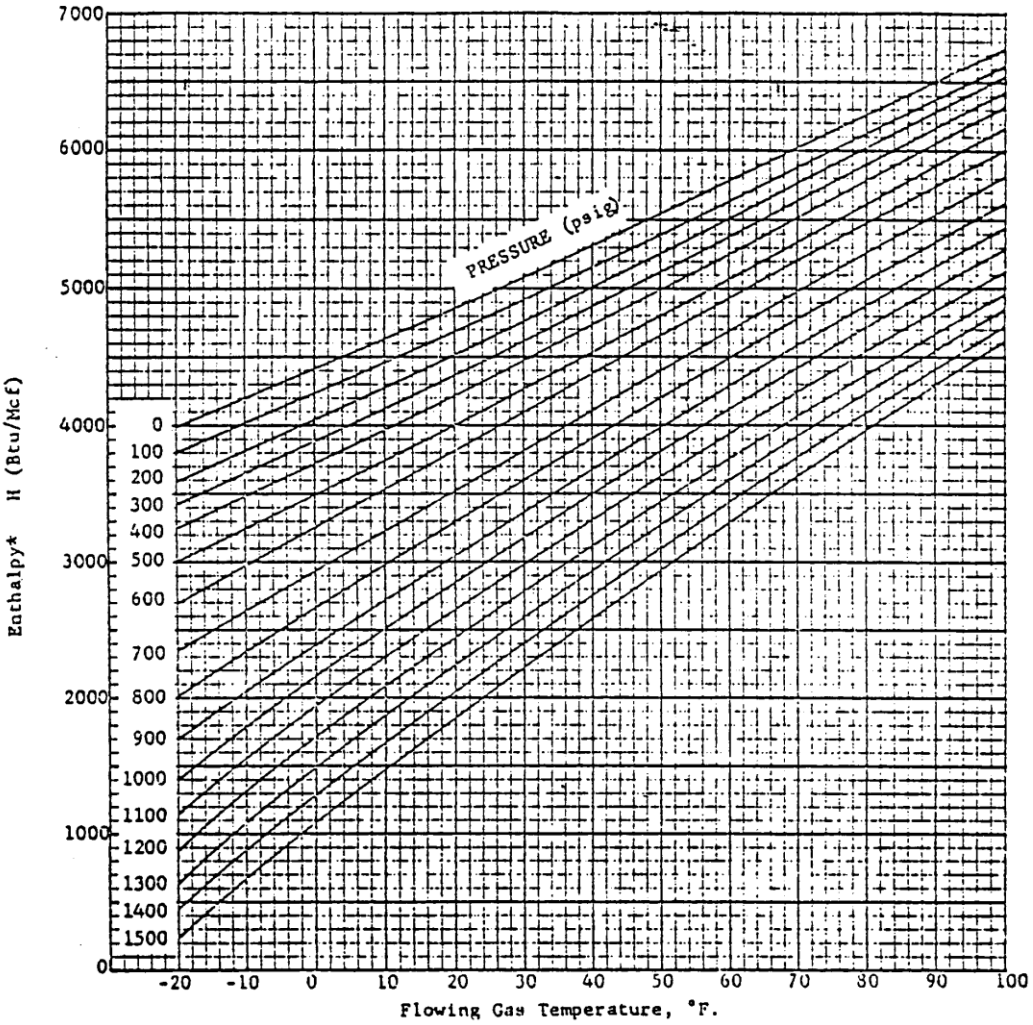
W.O.		COLUMBIA GAS DISTRIBUTION COMPANIES	Revisions	Date	By
Scale: NONE	Date		A		
Drawn: ELLYSON	7-24-81	Title: VARIOUS TYPES OF CATALYTIC HEATER INSTALLATIONS	B		
Checked: SCOLES	7-24-81		C		
Approved: R. T. B	7-24-81		D		
			Dwg. No. 774-C-1		

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Regulator Station Design**	Standard Number: **GS 2300.020**
Supersedes: 05/01/2014	**2 Inch and Larger**	Page 31 of 31

EXHIBIT F



TEMPERATURE-ENTHALPY DIAGRAM FOR NATURAL GAS, S.G. = 0.60.

Developed from Generalized Enthalpy Chart in B.F. Dodge, Chemical Engineering Thermodynamics, First Edition, McGraw Hill Co., Inc., 1944

* Enthalpy represents an energy level of the gas and is entirely distinct from its combustible value. The value of the enthalpy of any gas as determined by these curves is not the absolute value, but is merely an arbitrary value chosen to facilitate calculations. For the calculations concerned here, it is only necessary to know the change in enthalpy which occurs with pressure or temperature changes, therefore, the true value of enthalpy is immaterial.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2012	**Installation of a Non-primary Relief Valve**	Standard Number **GS 2300.022**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE None

1. GENERAL

This gas standard describes a method for the installation of an optional non-primary relief valve.

2. RELIEF VALVE SELECTION

The specifications for the recommended relief valves are given in Table 1. Refer to manufacturer's literature for additional information.

Table 1 – Recommended Relief Valves

Connection Size	Description	Maximum Inlet Pressure (PSIG)	Available Spring Range (PSIG)
2"	Fisher 1805-3	150	5 – 20 (Red) 10 – 50 (Blue) 35 - 125 (Yellow)
1"	Fisher 1805-2	150	5 – 35 (Green) 10 – 60 (Cadmium) 20 – 125 (Blue)
1"	Fisher 289H	100	1 – 4.5 (Pink) 4 – 15 (Red) 10 – 20 (Silver) 15 – 50 (Green)

3. LOCATION

The relief valve shall be installed on the downstream piping of the regulator station. See NDO design drawing REG-40 for construction details. Consideration may be given to using a new or existing tap location on the station piping that would be suitable for the installation of a non-primary relief valve. See NDO design drawing REG-41 for construction details. A non-primary relief valve installed on an existing tap location that is inside of a building, enclosure or vault shall be vented outside to a safe location.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2012	**Installation of a Non-primary Relief Valve**	Standard Number **GS 2300.022**
Supersedes: N/A		Page 2 of 2

4. INSTALLATION CONSIDERATONS

The relief valve should be set at the highest possible pressure that does not exceed the MAOP plus the allowable pressure build-up in accordance with Gas Standard GS 1750.040, “Relief Devices Inspection and Maintenance”.

5. INSPECTION AND TESTING

The non-primary relief valve shall be checked for proper operation during the annual station inspection in accordance with Gas Standard GS 1750.040, “Relief Devices Inspection and Maintenance”. Non-primary relief valve do not require annual capacity verification.

6. RECORDS

A record of each non-primary relief valve operational check shall be documented in the Company’s work management system or other applicable record.

MiSource
Distribution Operations

Gas Standard

Effective Date: 05/01/2014	**Metering Station Design**	Standard Number: **GS 2300.030**
Supersedes: 10/01/2010	**8C to 23M Rotary Meters**	Page 1 of 4

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

1. GENERAL

This standard details the engineering and design requirements for 8C through 23M rotary (in-line) meter stations. These stations are normally prefabricated and pre-tested for assembly at the job site. This standard applies to new installations and rebuilds of existing installations. For allowable design variations, refer to Section 13 in this standard.

2. DESIGN DRAWINGS

Detailed drawings and a bill of material for each design is available on the Standards intranet page. Table 1 lists the standard designs for 8C through 23M rotary meter stations by drawing number, description, regulator size, pipe size, design pressure and regulator type.

Table 1

Drawing No.	Description	Regulator Size (inches)	Pipe Size (inches)	Design Pressure (PSIG)	Regulation
Commercial Meter Stations – Pounds Delivery (other than fixed factor) (Meter before regulation)					
MET-7	8C, 11C,15C, 2M, 3M Rotary	2	2 x 2	175*	Sensus 461/441
MET-8	5M, 7M Rotary	2	2 x 3	175*	Sensus 461/441
MET-9	11M, 16M, 23M Rotary	2	3 x 4	175*	Sensus 461/441
Commercial Meter Stations – For Low Pressure Systems (no regulation included)					
MET-10	8C, 11C,15C, 2M, 3M Rotary	N/A	2	" W.C.	None
MET-11	5M, 7M Rotary	N/A	3	" W.C.	None
MET-12	11M, 16M, 23M Rotary	N/A	4	" W.C.	None
Commercial Meter Stations – Inches W.C. and Fixed Factor Delivery (Meter after regulation)					
MET-13	8C, 11C,15C, 2M, 3M Rotary	2 & 3	1-1/4 x 2	99	Various
MET-14	5M, 7M Rotary	2 & 3	2 x 3	99	Various
MET-15	11M, 16M, 23M Rotary	2 & 3	2 x 4	99	Various

Drawing No.	Description	Regulator Size (inches)	Pipe Size (inches)	Design Pressure (PSIG)	Regulation
Commercial Meter Stations with meter by pass – Inches W.C. (meter after regulation) -- Elevated Pressure (meter before regulation)					
MET-16	8C, 11C,15C, 2M, 3M Rotary	2	2	99	Various
MET-17	5M, 7M Rotary	2	2 x 3	99	Various
MET-18	11M, 16M, 23M Rotary	2	2 x 4	99	Various

* Station piping designed and pressure tested for a 175 psig design pressure, however, inlet pressure may be limited by type of 461/441 regulator installed.

3. SITE LOCATION

All meter stations shall be installed in accordance with the following location requirements.

a. Located outside where feasible and at a location that is accessible for reading, inspection, and servicing.

b. At a location not subject to damage by outside forces, such as, vehicles, power equipment etc. If no acceptable location is available, protection shall be provided for the piping as described in Section 9.

c. Inlet pipe shall be installed below grade where possible. Outlet piping may be installed above or below grade.

d. At a location away from a source of ignition, heat or hazardous work area.

e. In a location that would prevent venting gas from entering into the customer's building.

4. METER SIZING

Use local company capacity charts or sizing programs to determine correct meter size based on the total connected load. The following guidelines shall be followed when sizing the meter.

a. Meter station designs MET-7, 8 and 9 for 2M through 23M rotary meters place the meter before regulation therefore the meter capacity is determined using the line pressure.

b. Meter station designs MET-10, 11 and 12 for 2M through 23M rotary meters are not regulated and therefore are sized using line pressure.

c. Meter station designs MET-13, 14 and 15 for 8C through 23M rotary meters place the meter after regulation therefore the meter capacity is determined using the delivery pressure.

d. Meter station designs MET-16, 17 and 18 for 8C through 23M rotary meters are normally installed with the meter after regulation therefore the meter capacity is determined using the delivery pressure. However, Note 5 on the design drawings allows a variance so that on an elevated pressure installation the regulator can be placed after the meter in which case the meter capacity is determined using the line pressure.

e. For applications above the range of a 23M rotary meter, a properly sized turbine meter shall be used. Refer to GS 2300.040 “Metering Station Design” for approved turbine metering station designs. Exception: existing stock of 38M to 102M foot mount rotary meters may still be used in place of turbine meters until all have been scrapped out.

f. Proper meter size is determined by using the maximum hourly load. This is usually supplied by the New Business Team or can be determined based on the connected load and the quantity and type of equipment. Diversity factors (usually 0.7 or 0.8) are normally used when there are multiple pieces of equipment.

5. DELIVERY PRESSURE

Refer to local Company standards for delivery pressures allowed. The design pressure column in Table 1 gives the maximum delivery pressure for each of the rotary meter designs MET-7 through MET-18.

6. REGULATION

Refer to local Company standards for regulator selection for each meter station design.

7. BY-PASS STUBS AND METER BY-PASS PIPING

Meter designs MET-13, 14 and 15, have 1 ¼ or 2 inch by-pass stubs that permit by-passing the regulator and meter allowing for maintenance activities without service interruption to the customer. The valves on the by-pass stubs shall be full port, have the open end plugged and be locked in the closed position when not in use.

Meter designs MET-16, 17 and 18 have permanent meter by-pass piping to accommodate maintenance or exchange of the meter only without service interruption to the customer.

8. PRESSURE TESTING

Required test pressure and duration are stated on the individual design drawings. For additional pressure testing guidance refer to local Company standards (policy and procedures). Before testing remove regulator diaphragm cases and plate body, or remove entire regulator from station piping and install blank flanges or a spool piece.

9. PROTECTION

A physical means of protection (e.g., concrete filled metal posts) shall be considered for metering stations located outside where damage from vehicular traffic may be anticipated, however, protection may be mandatory in some regulatory jurisdictions. The design of the traffic protection shall conform to state and/or local regulatory requirements if applicable, whichever are more strict. Refer to GS 2300.020 “Regulator Station Design,” Exhibit A for bollard design details.

10. SUPPORT

These meter stations shall be supported by a bracket mounted to the customer’s building wall or mounted to a support post. The support post shall be installed by the Company. The support post shall be a two (2), three (3) or four (4) inch steel post mounted in concrete in the ground. Refer to drawings MET-7 to MET-18 for details.

11. CONCRETE PADS, COLUMNS AND RISER SUPPORTS

Concrete pads, columns and riser supports shall be specified by the engineer as needed to provide proper support for all station piping and equipment. Refer to GS 2300.020 “Regulator Station Design,” Exhibit B for minimum recommended specifications for station piping support structures. Concrete pads for meter stations, if needed, shall be provided by the customer to Company specifications.

12. FENCING AND STONE

To provide security, larger size metering stations sites may need to be fenced, graded and stoned if a concrete pad is not provided. Refer to GS 2300.020 “Regulator Station Design,” Section 18 for recommended guidelines for fencing and stone.

13. ALLOWABLE DESIGN VARIATIONS

In the case of highly critical loads, a station designed with a hard by-pass is allowed with the approval of the Gas Transmission and M&R Design Group. The by-pass shall include a regulator and a valve before and after the regulator.

When a station is being replaced or rebuilt, the existing riser may be used if it is in good condition, properly supported for the design and adequate in size to supply the required capacity.

MiSource
Distribution Operations

Gas Standard

Effective Date: 10-01-2010	**Metering Station Design**	Standard Number: **GS 2300.040**
Supercedes: 04/01/2008	**Turbine Meters**	Page 1 of 7

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
☑ NIFL	☑ CKY	☑ COH
☑ Kokomo Gas	☑ CMA	☑ CPA

1. GENERAL

This standard details the engineering and design requirements for 4, 6 and 8 inch turbine metering stations including the regulator stations for them. The standard configuration places the turbine meter station upstream of the regulation to allow for the use of a smaller meter. Turbine meter stations larger than 8 inches or ANSI class 600 shall be individually designed by the Gas Transmission and M&R Design Group. This standard applies to new installations and rebuilds of existing installations.

See GS 2300.020, “Regulator Station Design” for security, building, fencing and other premise related requirements.

2. DESIGN DRAWINGS

Detailed design drawings and bills of material for 4, 6 and 8 inch turbine meters stations and the matching regulator stations are available on the Standards intranet page. Table 1 lists all the standard designs by drawing number, description, meter size, pipe size, design pressure and regulator type.

3. SITE LOCATION

All meter stations shall be installed in accordance with the following location requirements.

a. Located outside when feasible and at a location that is accessible for reading, inspection, and servicing.

b. At a location not subject to damage by outside forces, such as, vehicles, power equipment etc. If no acceptable location is available, protection shall be provided for the station piping as described in Section 13.

c. Inlet pipe shall be installed below grade when possible. Outlet piping may be installed above or below grade.

d. Located in a ventilated place and greater than 15 feet from any source of ignition, heat, or hazardous work area. A clearance less that 15 feet is acceptable if necessary with the proper approvals.

e. In a location that would prevent venting gas from entering into the customer’s building.

4. DESIGN AND DRAWING REVIEW AND APPROVAL

Design parameters used and preliminary station drawings shall be submitted to the Gas Transmission and M&R Design Group and as appropriate, to Distribution or Transmission Operations, the Corrosion Group, and Technical Support for informational purposes.

All regulator station design deviations beyond those allowed in Section 17 “Allowable Design Variations”, shall be approved by the Gas Transmission and M&R Design Group and the appropriate Engineering Supervisor All station designs shall be submitted for approval through the normal channels.

Table 1

Drawing No.	Description	Meter Size (inches)	Pipe Size (inches)	Design Pressure (PSIG)	Regulation
Turbine Meter Stations – 275 PSIG Design Pressure					
MET-1	T-18/T-27 Turbine with By-pass run	4	4 x 4	175*	None
MET-2	T-35/T-57 Turbine with By-pass run	6	6 x 6	175*	None
MET-3	T-60/T-90 Turbine with By-pass run	8	8 x 8	175*	None
Turbine Meter Stations – 720 PSIG Design Pressure					
MET-4	T-18/T-27 Turbine with By-pass run	4	4 x 4	720	None
MET-5	T-35/T-57 Turbine with By-pass run	6	6 x 6	720	None
MET-6	T-60/T-90 Turbine with By-pass run	8	8 x 8	720	None
Regulator Stations for Turbine Meters – 275 PSIG Design Pressure					
MET-18	Monitor – Operator, Single Run, with Regulated By-pass	None	4 x 8	175**	4” Sensus 461/441
MET-19	Monitor – Operator, Single Run, with Regulated By-pass	None	4 x 8	175**	4” Dresser REDQ or Mooney Flowgrid
Regulator Stations for Turbine Meters – 720 PSIG Design Pressure					
MET-20	Monitor – Operator, Single Run, with Regulated By-pass	None	4 x 8	720	4” Dresser REDQ or Mooney Flowgrid
MET-21	Monitor – Operator, Single Run, with Regulated By-pass	None	4 x 8	720	4” Sensus 441

* Station piping designed and tested for a 175 PSIG design pressure based on 175 PSIG maximum pressure rating of aluminum body turbine meter.

** Station piping designed and pressure tested for a 175 psig design pressure, however, inlet pressure may be limited by type of 461/441 regulator installed.

5. METER SIZING

Use local Company capacity charts or sizing programs to determine correct meter size. Proper meter size is determined by using the maximum hourly load. This is usually supplied by the New Business Team or can be determined based on the connected load and the quantity and type of equipment. Diversity factors (usually 0.7 or 0.8) are normally used when there are multiple pieces of equipment. The following guidelines shall be followed when sizing the meter.

a. Turbine meters stations have been designed with the meter before regulation to allow the use of a smaller meter for a given load.

b. Existing stock of 38M to 102M foot mount rotary meters may still be used in place of turbine meters until all have been scrapped out.

c. Consideration should be given to the minimum system inlet pressure when sizing the meter.

6. METERING PRESSURE

Turbine meter designs MET-1, 2 and 3 use 175 PSIG aluminum body turbine meters and shall be used for metering pressures up to and including 175 PSIG. Turbine meter designs MET 4, 5 and 6 use ANSI Class 300 turbine meters and shall be used for metering pressures above 175 PSIG but not greater than 720 PSIG.

A 23M rotary (in-line) meter may be used in place of a turbine meter for delivery pressures up to and including 175 PSIG if the load requirements are within its range. See gas standard GS 2300.030, “Metering Station Design” for details.

7. REGULATOR SIZING

The engineer shall review the station design for proper pipe and regulator sizing, and flow velocity following the guidelines below.

a. Current regulator sizing programs should be used for determining regulator capacity, inlet/outlet pipe sizes and flow velocity. Above ground flow velocity should be a maximum of 60 fps (40 mph) in residential areas and 100 fps (68 mph) in industrial and outlying areas.

b. The regulator run has two regulators in a monitor-operator configuration and should be sized for the full capacity needed from the station. The regulated by-pass run shall also be sized for the full capacity needed from the station. Consideration should be given to the minimum system inlet pressure when sizing the regulators.

c. Proper sizing of the regulator run to match customer needs is critical for proper operation and regulator performance. The regulator run should be designed for a capacity of no more the 80% of its maximum calculated capacity.

d. The engineer should use all resources available to insure proper regulator sizing including Gas Transmission and M&R Design, Gas Planning, Gas Standards, Operations, existing design programs etc.

8. REGULATOR SELECTION

For pilot applications, the Dresser REDQ (formerly Grove TE) and Mooney Flowgrid regulators are the only regulators approved for use. For self operated (spring-loaded) applications the Sensus 441 and 461 series regulators (formerly Rockwell) are the only regulators approved for use. For operational considerations, it is recommended that Dresser REDQ and Mooney Flowgrid regulators not be mixed in the same station. A self operated (spring loaded) monitor regulator with a pilot loaded operator regulator may be used in the regulator run to help protect against failures from gas quality issues or if capacity and pressure fluctuations require. Use of a regulator other than those listed above shall be reviewed and approved by the Gas Transmission and M&R Design group.

Self operated (spring-loaded) regulators are preferred when:

a. outlet pressure is 75 psig or less,

b. outlet pressure fluctuations of 2-3 psig above and below the set point are acceptable or,

c. when gas quality issues (such as hydrocarbons or pipeline liquids) might cause operational problems.

Pilot operated regulators are preferred when:

d. outlet pressures are greater than 75 psig,

e. outlet pressure fluctuations of 2-3 psig above and below the set point are not acceptable or,

f. station is pit type design (pilot loaded is preferred for ease of maintenance and accessibility).

The Dresser REDQ and Mooney Flowgrid are interchangeable, however, for some large capacity demands or certain differential requirements the following should be considered.

g. Dresser REDQ provides easier maintenance under space constraints, such as, pits or enclosures.

h. Mooney Flowgrid provides greater capacity at low differentials

i. Mooney Flowgrid provides for higher capacity requirements (larger sizes)

8.1 Pilot Regulators and Filters

The Mooney model 20 pilot regulator is approved and recommended for use with both approved pilot regulators.

A filter is required on all pilot regulators. The Welker F5 and Mooney type 30 pilot filters are approved for this purpose. The Mooney type 30 pilot filter shall only be used on stations that are not expected to have problems with liquids.

8.2 Pilot Regulator Heaters

The use of insulation or catalytic heaters is recommended on all pilot regulators and control lines where there is potential for freezing.

If gas quality is expected to be a problem at a station consideration should be given to installing catalytic or flow (vortex) type pilot heaters. Catalytic heaters are normally used. Flow style (Vortex) heaters are not suitable for low flow conditions (less than 5 mcfh) but may be considered on constant flowing stations since they do not use gas and are extremely low maintenance. Vortex Heaters require a 1.3/1 pressure ratio to function properly.

9. BY-PASS RUN

Each turbine meter setting shall have a by-pass run including one ball valve sized as specified on the appropriate design drawing. When a regulator setting is used in conjunction with a turbine meter setting it shall have a by-pass run with one regulator and two ball valves, one upstream and one downstream of the regulator..

10. CONTROL LINES AND BLOWDOWN (PURGE)TAPS

A minimum of ½ inch control line and blowdown (purge) taps shall be installed as specified in the bill of materials and shown on the design drawings. Blowdown taps shall be located on station piping before and after all regulators, and on pipe sections where pressure can be bottled-up, for purposes of purging and relieving pressure during maintenance procedures. Control lines shall be a minimum of 3/8 inch stainless steel tubing. Larger sizes of tubing or pipe may be used when longer control line runs are required. The standard location for all control line taps is above grade on the outlet leg of the station piping downstream of the outlet valve. If it is necessary to locate taps below grade coated steel pipe shall be used for the buried portion. Additional taps are permissible when needed for gauges, pressure monitoring, etc.

11. PRESSURE TESTING

Required test pressure and duration are stated on the individual design drawings. For additional pressure testing guidance refer to local Company standards (policy and

procedures). Class 150 stations have a 275 PSIG design pressure and shall be tested at a minimum of 413 PSIG. Class 300 stations have a design pressure of 720 PSIG and shall be tested at a minimum of 1080 PSIG. Before testing remove regulator diaphragm cases and plate body, or remove entire regulator from station piping and install blank flanges or a spool piece.

When ANSI Class 125 Sensus 441 or 461 regulators with 175 PSIG maximum working pressure are used, the station piping shall still be tested for a 275 design pressure (413 PSIG minimum test pressure) to allow for the possible substitution of a Mooney Flowgrid or Dresser REDQ regulator in the future.

12. INSPECTION OF WELDS

All welds shall be inspected per the local company welding manual. In addition, if the design pressure will produce a hoop stress on the station piping of 20% or more of its Specified Minimum Yield Strength (SMYS) nondestructively test all welds up to the outlet valve(s). Refer to GS 1210.010, “Nondestructive Testing” for specific requirements.

13. PROTECTION REQUIREMENTS

A physical means of protection (e.g., concrete filled metal posts) should be considered for metering stations located outside where damage from vehicular traffic may be anticipated, however, protection may be mandatory in some regulatory jurisdictions. If applicable, the design of the traffic protection shall conform to state and/or local regulatory requirements, whichever is more strict. See GS 2300.020, “Regulator Station Design - 2” and Larger Requirements”, Exhibit A for bollard design details.

14. VALVES

Standard port (reduced port) ball valves are standard in all stations designs and are specified on the bill of materials. Full port ball valves may be substituted if necessary for capacity reasons.

15. COATING

Station piping shall be primed and coated with an approved coating system.

16. CONCRETE PADS, COLUMNS AND RISER SUPPORTS

Concrete pads, columns and riser supports shall be specified by the engineer as needed to provide proper support for all station piping and equipment. See GS 2300.020, “Regulator Station Design”, Exhibit B for minimum recommended specifications for station piping support structures. Concrete pads for meter stations, if needed, shall be provided by the customer to Company specifications

17. ALLOWABLE DESIGN VARIATIONS

The following design variations are allowable at the discretion of the engineer without additional approval:

a. 38M and larger foot mount rotary meters will not be purchased in the future, existing stock can be recycled until scrapped.

b. Selection of meters within the 16M to 23M overlap range to be at the discretion of the engineer based on application.

c. Full port ball valves may be substituted and the inlet pipe size increased in a station design for capacity reasons.

d. Slip flanges are allowed.

e. Regulators other than those specified in Section 8 may be used if required for specific applications and if approved by the Gas Transmission and M&R Design Group.

NiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Electronic Daily Measurement Equipment/Outputs**	Standard Number: **GS 2300.064(CG)** P&P 535-10
Supersedes: N/A		Page 1 of 12

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. DEFINITION

"Outside party" means a customer or a customer's Gas Marketer or Energy Manager who has signed a letter to act as the customer's agent.

2. GENERAL

When requested by an outside party various forms of electronic daily measurement readings (outputs) can be provided. Form C 3031, "Columbia's Policy Regarding Requests by Outside Parties to Provide Electronic Daily Measurement Equipment/Outputs," Exhibit A, Shall be furnished to the outside party in order for the outside party to determine what equipment they want installed.

3. PROCESSING REQUESTS

A request from an outside party for daily measurement output data will be directed to either an Area Service Supervisor, a District GTS Coordinator, or a District Marketing Engineer. The Company contact will complete Form C 3030, "Request for Electronic Daily Measurement," Exhibit B, with the outside party and request a non-refundable $100 administrative fee.

After receipt of the non-refundable administrative fee, the Company contact will forward Form C 3030 and the fee to the Area Service Supervisor, if necessary. The Area Service Supervisor will process the fee by attaching the check to Form C 998, "Notice of Receipt of Payment for Miscellaneous Accounts Receivable," Exhibit C. Form C 998 shall be completed to credit the $100 fee to the design Capital Job Order prepared for the particular customer requesting electronic measurement application and forwarded to Accounting, Tax and Risk Management - Asset Accounting. The $100 fee will be applied toward the actual cost of the installation; or, in the few cases where no installation costs are involved, the $100 fee will cover the normal cost of processing the request. The Area Manager may waive the $100 administrative fee for larger industrial accounts or when it is in the best interest of the Company.

A copy of Form C 3030 will be forwarded by the Area Service Supervisor to the District

Operations Manager (or equivalent) and to Engineering - Service Operations. The Area Service Supervisor will develop the cost estimate with the assistance of Engineering - Service Operations and create the design Capital Job Order. The estimated project cost shall consider markups for Aid-in-Construction tax gross-up for Virginia.

Upon completion of the estimated project cost the Area Service Supervisor will contact the outside party to complete Form C 3032, "Agreement to Install Daily Measurement Equipment on Columbia's Measurement Facilities," Exhibit D, and obtain from the outside party the estimated project cost minus the initial $100 administrative fee.

Note: It is necessary to attach Form C 3031, "Columbia's Policy Regarding Requests by Outside Parties to Provide Electronic Daily Measurement Equipment/Outputs," Exhibit A, as Appendix B to Form C 3032 to make the agreement complete.

Upon receipt of payment, the Area Service Supervisor shall complete Form C 998, "Notice of Receipt of Payment for Miscellaneous Accounts Receivable," and forward the payment and completed form to Accounting, Tax and Risk Management - Asset Accounting for processing.

Note: Form C 998 shall credit the construction Job Order(s). Where income tax factor B applies, Form C 998 shall also credit 421-3000-2020-0000-20610 using the classification block(s) labeled "TO GENERAL ACCOUNTING (Cr)" and "Advance Payment" shall be marked thereon.

The Area Service Supervisor shall also forward completed Form C 3032 to the Area Manager for approval and schedule the project for construction. Engineering - Service Operations will assist in coordinating the installation. Copies of the approved Form C 3032 shall be distributed by the Area Service Supervisor as indicated below:

a. Outside party
b. Initial Company contact, if applicable
c. Job Order Completion Report

The original approved Form C 3032 shall be retained on file by the Area Service Supervisor.

4. RECORDS

Upon completion of the installation, DIS shall be updated to reflect customer provided for services.

5. PAPER FLOW DIAGRAM

Exhibit E reflects the paper flow diagram of the approval and billing process.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Electronic Daily Measurement Equipment/Outputs**	Standard Number: **GS 2300.064(CG)** P&P 535-10
Supersedes: N/A		Page 3 of 12

EXHIBIT A
(1 OF 2)

Appendix B

COLUMBIA'S POLICY REGARDING REQUESTS BY OUTSIDE PARTIES TO PROVIDE ELECTRONIC DAILY MEASUREMENT EQUIPMENT/OUTPUTS

For the purpose of this policy an "outside party" shall mean a Columbia customer, or a Columbia customer's Gas Marketer or Energy Manager who has signed an agency letter to act as the customer's agent.

Where Columbia has previously installed electronic measurement equipment Columbia will offer the outside party:

a. a form A corrected output pulse. The estimated cost to provide this output will range from $800 to $2000 for each meter, depending on the type of electronic measurement equipment Columbia presently has in service,

b. an analog corrected output. The estimated cost to provide this output will range from $1000 to $2000 for each meter, depending on the type of electronic measurement equipment Columbia presently has in service,

c. telephonic access to electronic flow corrector or RTU data ONLY where Columbia has previously installed electronic measurement equipment in service. The cost to provide this output will range from $0 to $3000, depending on the type of electronic measurement equipment Columbia presently has in service. The party may also have to purchase the Customer Monitor software, and IBM compatible personal computer and a Hayes compatible modem.

It should be noted that in special situations the actual costs may exceed the estimate cost ranges provided above. The installation of the above mentioned outputs may require the outside party to pay the cost of a Columbia selected sub-contractor. In addition, the outside party may have to provide an analog telephone service and 110 volts AC electricity, depending on the type of electronic measurement equipment Columbia presently has in service.

Where Columbia has not previously installed electronic measurement equipment, Columbia will install on request selected electronic measurement equipment in order for outside parties to obtain form A corrected output pulses, an analog corrected output or telephonic access to electronic flow corrector data. The estimated cost to provide this will range from $5000 to $8500 for each meter, but may be higher in special situations. The installation of electronic measurement equipment to provide these outputs may require the outside party to pay the cost of a Columbia selected sub-contractor. In addition, the outside party may have to provide an analog telephone service and 110 volts AC electricity, depending on the type of electronic measurement equipment Columbia presently has in service. The party may also have to purchase the Customer Monitor software, and IBM compatible personal computer and a Hayes compatible modem.

Columbia will offer a form A uncorrected output pulse for large volume or small commercial customer meter(s) where it is possible to install a pulsing device. The estimated cost to provide this output will range from $1200 to $1500 for each meter, depending on the meter type. It should be noted that in special situations the actual costs may exceed this estimated cost range.

All corrected output pulses, analog corrected output pulses and uncorrected output pulses will:

a. terminate outside of Columbia's measuring station buildings and/or

b. be at a safe codified distance from the nearest measuring station flange or meter setting within an enclosure containing an intrinsic safety barrier.

With regards to uncorrected pulse outputs, meter type will often dictate the type of pulsing device to be installed. Each pulsing device will provide two uncorrected pulse outputs, one for the use of Columbia the other for the use of the party requesting the pulse. To provide an uncorrected output pulse from a meter, Columbia will install, own and maintain at their discretion one of the following pulsing devices:

Dresser Pulse Contractor CTR-TC/PLSR
Mercury 212 Pulse Transmitter
Imac Pulsimatic sandwich pulser

A Request for Electronic Daily Measurement (Columbia's Form C 3030) will be completed by the outside party and CDC's local Industrial Marketing Engineer for EACH Columbia Measuring Station (Note: A measuring station may include multiple meters).

FORM C 3031 CPS

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Electronic Daily Measurement Equipment/Outputs**	Standard Number: **GS 2300.064(CG)** P&P 535-10
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The outside party will pay an administrative fee of $100 for the processing of EACH Request for Electronic Daily Measurement form. This fee is non-refundable, but will be applied toward the total cost to provide the outside party with the requested output. If no cost is incurred to provide the customer requested output, the $100 administrative fee will be used to cover normal processing costs.

The outside party will execute a standard Columbia legal agreement for each measuring station or meter setting from which they wish to obtain information prior to the installation of any equipment on that measuring station or meter setting. The Columbia legal agreement must be executed and returned within two months of its original mailing date. This policy shall be incorporated into the legal agreement and be binding on each outside party and its subcontractors.

The outside party will pay for all estimated labor and material costs and provide any services as stated in the standard Columbia legal agreement prior to the installation of any equipment at that measuring station or meter setting. If the actual cost is less than the estimated and paid amount, Columbia will reimburse the outside party the amount of the excess payment. If the actual cost exceeds the estimated and paid amount, the outside party will pay Columbia the additional amount.

The outside party will pay for future maintenance and troubleshooting of any equipment installed for the purpose of providing the outside party measurement information.

Columbia will allow an outside party to tap a Columbia owned telephone line (given the specifications below) if the outside party wishes to connect a daily measurement device which will initiate a call into a centralized location a maximum of once per day for a total transmission time of two minutes or less. Columbia retains the right to disconnect this tap at any time Columbia determines that it interferes with the operation of Columbia's measurement equipment.

Columbia will not allow an outside party to tap line pressure or temperature. Columbia will not provide or allow output signals from pressure or temperature transmitters.

Columbia will not allow an outside party to install or own any type of equipment inside of Columbia's measuring station building (at those sites where a building surrounds the Columbia measurement setting) or at any point closer to the measuring station flange or meter setting than the termination of the output provided by Columbia as indicated by the location of the intrinsic safety barrier.

Columbia will not allow an outside party to install or own any type of equipment at any point closer to the measuring station flange or meter setting (at those sites where Columbia measurement settings that are not located within a building) than the termination of the output provided by Columbia as indicated by the location of the intrinsic safety barrier.

Columbia will not provide an outside party with estimated or averaged correction factors or pressures for calculating a corrected volume from an uncorrected pulse output. (This information may be estimated from the customer's monthly bill.)

Columbia retains the right to change, alter, modify, expand, disconnect, discontinue or substitute any equipment or telephone lines located at its measuring station sites as it deems necessary.

The outside party must realize that any information provided in the form of telephonic access, corrected pulse output, corrected analog output, uncorrected pulse outputs or estimated volume corrections of uncorrected pulse outputs via an average line pressure is unverified and unaudited data, and that Columbia will not be liable for the inaccuracy of this information.

The outside party shall agree that Columbia's primary measurement equipment and computation procedures will determine the billing gas quantities for a Columbia meter. Any requests by an outside party to verify the accuracy of any Columbia measurement equipment will result in the outside party paying the total cost associated with that verification process whenever the verification process shows that Columbia's measurement equipment is in tolerance.

The installation of all electrical facilities shall conform to all provisions of the National Electric code (Subpart 70), the American Gas Association Classification of Gas Utility Area for Electrical Installation (SF0277), and ANSI/ISA RP 12.6 Installation of Intrinsically Safe Instrument Systems in Class I Hazardous Locations. All electrical facilities installed at exterior Columbia measurement and regulation facilities or on the outside walls of Columbia's measurement and regulation building shall be classified and designed for Class I, Division II, Group D locations.

MiSource
Distribution Operations

Gas Standard

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EXHIBIT B
(1 OF 2)

COLUMBIA GAS
Distribution Companies

REQUEST FOR ELECTRONIC DAILY MEASUREMENT

Date ____/____/____ (1)

Outside Party Data

Company Name: (2)

Mailing Address: (3)

Contact Person: (4) Title: (5)

Telephone Number: (____) (6)

CDC Data

Customer Name: (7) Company: (8)

PSID(s): (9) District: (10)

Measuring Station Number: (11)

Service Address: (12)

Number of Meters: (13)

Meter(s) (Kind & Size): (14)

Marketing Contact: (15)

Service Supervisor: (16)

Requested Outputs/Installations:

_____Read Only Telephone Access*

_____Corrected Pulse Output (Form A)* (17)

_____Corrected Analog Output (4-20Ma)*

_____Installation of an Electronic Flow Corrector

_____Uncorrected Pulse Output (Recommended Equipment: _____)

_____Tap from a CDC owned telephone line (if available)

_____Other _____

* Available only where CDC has installed electronic flow correctors

$100 Administrative Processing Fee Received Date ____/____/____ (18)

Furnish Copy of Form to: Columbia Gas Distribution Companies
Engineering - Service Operations
200 Civic Center Drive, P. O. Box 117
Columbus, Ohio 43216-0117
(614) 460-6213

FORM C 3030 CPS

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Electronic Daily Measurement Equipment/Outputs**	Standard Number: **GS 2300.064(CG)** P&P 535-10
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EXHIBIT B
(2 OF 2)

Instructions for the completion of Form C 3030, "Request for Electronic Daily Measurement."

The following items are keyed to Form C 3030, page 1 of this Exhibit.

Key	Item	Description
1	Date	Insert date request was made from outside party.
2	Company Name	Insert outside party company name.
3	Mailing Address	Insert address of outside party to be billed.
4	Contact Person	Insert name of person to be contacted.
5	Title	Insert title of contact person.
6	Telephone Number	Insert number where contact person can be reached.
7	Customer Name	Insert name if different from Key 2.
8	Company	Indicate appropriate CDC Company.
9	PSID(s)	Insert PSID. For stations with multiple runs list PSID for each run.
10	District	Self-explanatory.
11	Measuring Station Number	Insert M.S. No. For stations with multiple runs identify run sequence to each PSID in Key 9.
12	Service Address	If different from Key 3 insert address where daily measurement equipment will be installed.
13	Number of Meters	Indicate number of meter requiring daily measurement equipment.
14	Meter(s) (Kind and Size)	Self-explanatory.
15	Marketing Contact	Self-explanatory.
16	Service Supervisor	Self-explanatory.
17	Request Outputs/ Installations	Indicate option selected by outside party.
18	$100 Administrative Fee Received	Indicate date fee was received.

MiSource
Distribution Operations

Gas Standard

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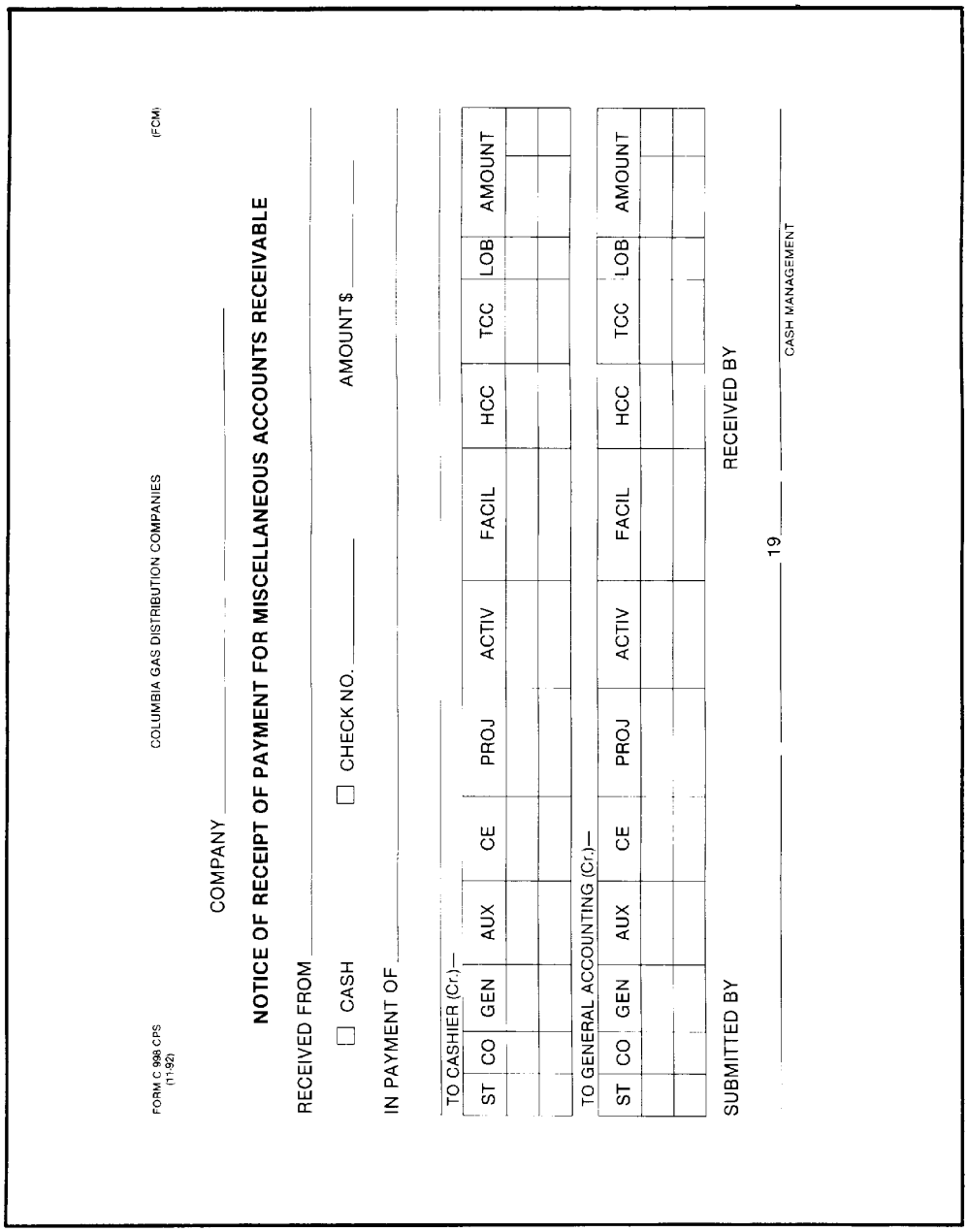
EXHIBIT C



FORM C 998 CPS (11-92)

COLUMBIA GAS DISTRIBUTION COMPANIES (FCM)

NOTICE OF RECEIPT OF PAYMENT FOR MISCELLANEOUS ACCOUNTS RECEIVABLE

COMPANY _____

RECEIVED FROM _____

☐ CASH ☐ CHECK NO. _____ AMOUNT $ _____

IN PAYMENT OF _____

TO CASHIER (Cr.)

ST	CO	GEN	AUX	CE	PROJ	ACTIV	FACIL	HCC	TCC	LOB	AMOUNT

TO GENERAL ACCOUNTING (Cr.)

ST	CO	GEN	AUX	CE	PROJ	ACTIV	FACIL	HCC	TCC	LOB	AMOUNT

SUBMITTED BY _____ RECEIVED BY _____

19 _____

CASH MANAGEMENT

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Electronic Daily Measurement Equipment/Outputs**	Standard Number: **GS 2300.064(CG)** P&P 535-10
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EXHIBIT D
(1 OF 4)

AGREEMENT TO INSTALL DAILY MEASUREMENT EQUIPMENT ON COLUMBIA'S MEASUREMENT FACILITIES

This Agreement is made this _____day of _____, 19___, by and between_____
NAME OF COMPANY
_____, Inc., (hereafter, "Columbia"), a corporation with its principal offices at 200 Civic Center Drive, P.O. Box 117, Columbus, Ohio 43216-0117, and _____, (hereafter, "Customer"), a corporation with offices at _____.

RECITALS

WHEREAS, Customer has formally requested and applied for installation by Columbia of daily measurement equipment on Columbia's measurement facilities and,

WHEREAS, Customer has accepted Columbia's policy regarding the installation of daily measurement equipment on Columbia's measurement facilities; and

WHEREAS, Columbia has reviewed Customer's application and is capable and willing to perform such installation services in accordance with the terms and conditions of this Agreement;

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, Columbia and customer agree as follows:

I. SCOPE OF WORK

See Appendix A

II. TERM

The term of this Agreement runs one year from the date of its execution. Thereafter, this Agreement automatically renews for periods of one (1) year from the expiration date until either party terminates the contract by issuing a thirty (30) day prior written notice of termination to the other party.

III. PAYMENT

Prior to any installation by Columbia, Customer promises to make payment to Columbia in the amount equal to Columbia's estimated cost of labor and materials costs of Columbia's installation of the daily measurement equipment, which estimate is listed in the Scope of Work. If the actual cost of the installation exceeds the estimated and paid costs, Customer agrees to pay Columbia the additional cost within thirty (30) days of billing. If the actual cost of the connection is less than the estimated and paid amount, Columbia agrees to reimburse Customer the amount of excess payment within thirty (30) days of the determination of actual costs. Data supporting the actual cost of the installation will be available to Customer upon written request to Columbia.

IV. CONDITIONS

Customer agrees that Columbia's performance of this Agreement is conditioned upon Customer's complete performance to Columbia's satisfaction of the following conditions:

1. Prior to any installation by Columbia, Customer promises to provide and install, at Customer's expense, the facilities and/or services, which Columbia and Customer agreed, pursuant to Section I of this Agreement, are necessary for Columbia's installation of the daily measurement equipment indicated in paragraph 2 of Appendix A. Customer may subcontract for the installation of the facilities indicated in paragraph 4 of Appendix A.
2. Customer and its subcontractors shall not install or own any type of equipment inside the measurement station building facility, or at any point closer to the measuring station flange or meter setting than the termination of the output provided by Columbia as indicated by the location of the intrinsic safety barrier.
3. Customer and its subcontractors shall not tap or measure line pressure or temperature.
4. Customer and its subcontractors shall provide and install, at Customer's expense, software and computer equipment necessary for Customer to access data from Columbia's daily measurement equipment via telephone line.
5. Customer's installation, or Customer's subcontractor's installation, of all electrical facilities shall conform to all existing or amended provisions of the National Electric Code (Subpart 70), the American Gas Association classification of Gas Utility Area for Electrical Installation (SF0277), and ANSI/ISA RP 12.6 Installation of Intrinsically Safe Instrument Systems and Class I Hazardous Locations. For the purpose of installing electrical facilities, Columbia's measurement and regulation facilities shall be classified and designed Class I, Division I, Group D Locations.
6. The installation and operation of any facilities, is subject to Customer's and its subcontractors complete compliance with Columbia's Policy Regarding Requests By Outside Parties To Install Daily Measurement Devices, which policy is attached to and hereby incorporated into and made a part of this Agreement as Appendix B. In the event of any conflict between Appendix B and any other provision of the Agreement, including Appendix A, and the other provisions of the Agreement shall govern and supersede Appendix B.
7. Customer agrees that each additional or replacement installation proposed by Customer shall be submitted to Columbia by separate formal application, and that each additional installation shall be subject to prior approval of the application by Columbia, and to the prior execution of a separate Agreement by Customer.

Customer's failure to fulfill any one of the aforementioned conditions is grounds for Columbia to immediately terminate this Agreement.

V. COLUMBIA'S RIGHTS AND RESPONSIBILITIES

1. Columbia will own, operate and maintain the equipment indicated in paragraph 1 of Appendix A to this Agreement subsequent to its installation. Customer agrees that Columbia retains the right to change, alter, modify, expand, substitute, discontinue or disconnect Columbia's primary measurement facilities or equipment at the measuring station sites at any time, as it deems necessary, at Columbia's sole risk and expense.

FORM C 3032 CPS

EXHIBIT D
(2 OF 4)

2. Customer agrees to assume the full cost and risk for immediate removal, adaptation, or installation of Customer's equipment indicated in paragraph 4 of Appendix A to this Agreement whenever Columbia determines, for any reason, that removal, adaptation or installation is necessary to effectuate changes in Columbia's primary measurement facilities and equipment. Customer furthermore agrees that Columbia retains the right to immediately disconnect or discontinue, at Customer's expense, the operation of Customer's facilities, equipment and telephone lines or splices which are installed under this Agreement if, in Columbia's sole judgment, continued operation of the equipment could in any way adversely affect the ability of Columbia to meet its public utility obligation to provide service to its customers. Such disconnection or discontinued use of the daily measurement equipment or facilities shall continue until Columbia notifies Customer that use of the equipment and facilities can be safely resumed.

VI. WARRANTY

1. Columbia does not make any warranty or representation, express or implied, with respect to the accuracy, verification, completeness or usefulness of the unaudited information and measurement data obtained by Customer under this Agreement. Customer agrees that Columbia will not be liable or responsible in any way for the inaccuracy of the unaudited data retrieved from the measurement equipment and facilities.

2. Customer agrees that Columbia's primary measurement equipment and computation procedures will determine the billing amounts for gas quantities consumed as reflected on Columbia's meter. Should Customer challenge the accuracy of the primary measuring device used, Columbia shall test the primary measuring equipment and/or the meter. A representative of Customer may be present at the test. If the primary measuring equipment is found to be in error, and the resultant aggregate error in computed deliveries at the recording rate corresponding to the average hourly rate of gas flow for the period since the preceding test is not more than two percent (2%), then previous consumption shall be considered accurate, and Customer shall pay the cost of testing the meter. If, however, any primary measuring equipment is found to be in error, and the resultant aggregate error in computed deliveries exceeds the two percent (2%) tolerance, then the previous computed deliveries shall be adjusted by Columbia to zero error and the cost of testing the meter shall be borne by Columbia. Such adjustment shall be made for a period not to exceed thirty (30) days prior to the date of challenge by Customer. All equipment shall, in any case, be adjusted at the time of test to record correctly.

VII. INDEMNIFICATION

Customer agrees to indemnify and hold Columbia, its agents and employees harmless from and against any and all losses, liabilities, demands payments, actions, legal proceedings, recoveries, settlements, judgments, costs, expenses, attorney fees, orders and decrees of every nature and description brought or recovered against or incurred by Customer, whether groundless or not, for injuries to or death of any person including, but not limited to, the agents or employees of Customer or any subcontractor, or damage to any property regardless of ownership, including the loss of use of such property solely, jointly or otherwise caused by or arising out of the negligence, recklessness, intentional misconduct, or strict liability of Customer, its subcontractor or subcontractors, agents or employees in performance of their duties under this contract.

Customer shall and will at its own cost and expense defend any such suit, action or proceeding, whether groundless or not, which may be commenced against Columbia, its agents or employees based on the Customer's negligence, recklessness, intentional misconduct, or strict liability, and Customer shall pay any and all judgments or costs, which may be recovered in any such action, claim, suit, or proceeding, and pay all expenses including, but not limited to, attorney fees, investigative costs, and court costs, which may be incurred if or by any reason of such action, claim, or proceeding or suit. If it is determined in any such suit, action, or proceeding in which Columbia is a party and for which Customer incurs the cost of defending Columbia, that Columbia's negligence caused or contributed to the injuries or damages, Columbia will reimburse Customer for any defense costs reasonably incurred by Customer in proportion to Columbia's negligence, provided Customer gives Columbia written notice in advance of incurring such cost.

Customer further agrees that it shall indemnify and hold harmless Columbia from and against any and all loss, damage and liability and from any and all claims for damages on account of or by reason of bodily injury, including death, which may be sustained or claimed to be sustained by any person, including the employees of Customer and of any subcontractor of Customer, and from and against any and all damages to property, including loss of use, and including property of Columbia, to the extent caused by or arising out of or claimed to have been caused by or to have arisen out of the negligence, recklessness, intentional misconduct, or strict liability of Customer or its agents, employees or subcontractors in connection with the performance of this contract, and Customer shall pay any and all judgments which may be recovered in any such action, claim, proceeding, or suit, and defray any and all expenses, including costs and attorneys' fees, which may be incurred in or by reason of such action, claims, proceedings or suits.

Notwithstanding the foregoing paragraph, Columbia shall be entitled to representation by attorneys of its own selection. In any case, Columbia, at its option, shall be the sole judge of the acceptability of any compromise or settlement of any claims or actions against Columbia.

To the extent permitted by law, Customer expressly waives the benefit for itself and all subcontractors insofar as the indemnification of Company is concerned, of the provisions of any applicable workers' compensation law which limits the tort or other liability of an employer on account of injuries to the employer's employees, whether by statutory immunity or otherwise.

The obligation of Customer to indemnify Columbia shall survive the termination or cancellation of this Agreement.

All provisions of this Section are severable, and the unenforceability or invalidity of any one or more of such provisions shall not affect the enforceability or validity or the remaining provisions of this section.

VIII. SUCCESSORS & ASSIGNS

Except for assignment to a wholly owned subsidiary, a parent or an affiliate of the parties to this Agreement, this Agreement shall not be assigned by either party without the prior written consent of the other party.

EXHIBIT D
(3 OF 4)

In any case, this Agreement shall be binding on, and inure to the benefits of, the successors and assigns of Columbia and Customer.

IX. WAIVER CLAUSE

No course of dealing, or any failure of either of the parties to this Agreement to strictly enforce any terms, rights or conditions of this Agreement, shall be construed as a waiver of such terms, rights or conditions.

X. NOTICES

All notices, except notices related to billing, shall be effective only if mailed by registered mail, or by certified mail, return receipt requested, to the signatories of this contract at the addresses designated on the signature page of this Agreement.

XI. MODIFICATIONS

This Agreement shall not be amended, modified or waived except by an instrument in writing, signed by Columbia and Customer.

XII. GOVERNING LAW

This Agreement shall be governed and construed in accordance with the laws of the State of Ohio.

XIII. ENTIRE AGREEMENT

This Agreement sets forth the entire understanding between Columbia and Customer and supersedes all prior Agreements between the parties with respect to the subject matter of this Agreement.

ACCEPTED AND AGREED TO THIS

_____DAY OF_____, 19___ By:

Customer: _____

Address: _____

_____

_____

By: _____

Title: _____

Date: _____

_____ , INC.
Name of Company

_____
Authorized Signature

_____
Title

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MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Electronic Daily Measurement Equipment/Outputs**	Standard Number: **GS 2300.064(CG)** P&P 535-10
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EXHIBIT D
(4 OF 4)

APPENDIX A
SCOPE OF WORK

1. Columbia, as an independent contractor, promises to purchase and install, at Customer's expense, certain equipment know as _____ to provide the customer with the output as indicated below:

_____ Read only telephone access

_____ Corrected pulse output (Form A)

_____ Corrected analog output (4-20 Ma)

_____ Uncorrected pulse (Form A)

_____ Uncorrected pulse (Form C) Output

_____ Tap from a CDC telephone line

_____ Other _____

2. Customer shall use the equipment to obtain daily measurement data from Columbia's measurement facility at _____ (CDC measurement station No_____).

3. Prior to any installation by Columbia, Customer promises to make payment to Columbia in the amount of _____ Dollars ($_____ .00), which is the sum Columbia has estimated is necessary to pay for the labor and materials costs of Columbia's installation of the daily measurement equipment.

4. In accordance with Section IV-1 of the Agreement, Customer promises to provide prior to any installation by Columbia, the following facilities:_____

_____

Customer may employ a subcontractor for the installation of the following equipment: _____

_____

_____

Customer shall own, operate and maintain all facilities installed by Customer and its subcontractors subsequent to their installation, subject to Columbia's rights expressed in Section V-2 of the Agreement.

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MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Electronic Daily Measurement Equipment/Outputs**	Standard Number: **GS 2300.064(CG)** P&P 535-10
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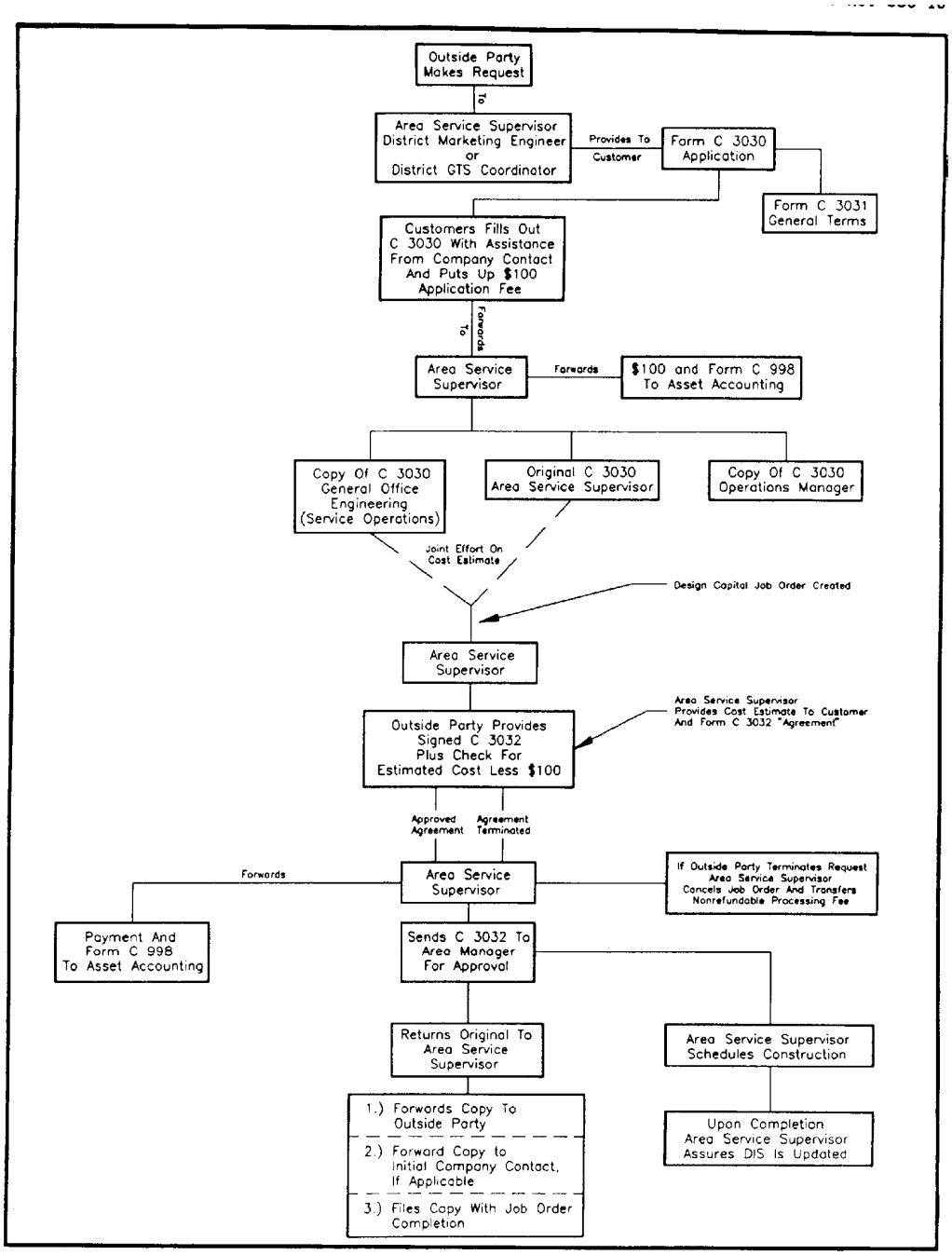
EXHIBIT E



MiSource
Distribution Operations

Gas Standard

Effective Date: 07/07/1994	**Measuring and /or Regulation Station Design Request**	Standard Number: **GS 2300.080(CG)** P&P 535-9
Supersedes: N/A		Page 1 of 8

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

Either of the following two methods, referred to as an M & R Request, can be used to obtain a facilities M & R Design from Engineering - Facilities Planning:

a. Form C 1459, "Measuring and/or Regulation Station Design Request," Exhibit A.

b. "Regulator Design Assistant (RDA)" computer program, Exhibit B. (To obtain access to the RDA program, contact Facilities Planning.)

1.1 When Form C 1459 is Required

Form C 1459 shall be used to request:

a. the assignment of a new measuring station number.

b. the design of a valve set with pipe diameter 12" or larger and all above-ground valve settings (see GS 2400.010, GS 2400.010(KY), or GS 2400.010(PA) “Critical Valve Design Guidelines” or GS 2400.020 “Transmission Line Valve Design Requirements”).

c. the design for accessory equipment for measuring and/or regulation stations, such as gas cleaning, heating (water bath or infra-red), remote control, odorization, etc.

1.2 Conditions Not Requiring Form C 1459 or an RDA Request

Form C 1459, or an RDA request, is not required when:

a. a measuring station will be relocated intact to a different part of the customer's site and still utilize the same supply point.

b. a measuring station will be retired.

c. a standard design drawing is selected for the installation of a regulator (no measurement involved) and a completed "Station Design Memorandum," Exhibit C, is affixed to the Job Order. The "Station Design Memorandum" is

part of the output generated from the RDA program.

2. DATA VERIFICATION

The Operations Engineer is responsible for verifying the following data on Form C 1459 or in the RDA program (Exhibit B):

a. normal operating pressure range

b. MAOP

c. inlet/outlet piping pressure range

The Operations Engineer will review the customer flow (load) data, customer revenue class (Exhibit D) and the customer minimum and maximum deli-very pressure requirements. The Operations Engineer will verify flow data for Local Purchase and Metered Town Border PODs.

3. M & R REQUEST PROCESSING

The District shall submit a M & R Request to Engineering - Facilities Planning to initiate the station design process for:

a. actual specialized design, or

b. selection of a standard M & R Drawing, or

c. verification of the District's standard drawing selection.

When the District only needs a station number assignment, it shall submit an M & R Request to Engineering - Service Operations.

4. ASSIGNMENT OF STATION NUMBERS

Assignment of a measuring station number is the responsibility of Engineering - Service Operations. The M & R Request must include the PSID number(s) in order to assign a measuring station number. Engineering - Facilities Planning shall be responsible for obtaining from Engineering - Service Operations the measuring station number for each M & R Request processed for specific design considerations.

One completed original Form C 1459 can be submitted for customers with multiple listings. A typed list of all additional locations containing the same information with individual PSID numbers shall be attached.

Prior to submitting an M & R Request for a station number, the District shall verify through DIS that the customer does not have a GMB measuring station number already assigned.

Note: A regulator station number will be assigned by the District to:

a. CDC-owned regulation at each new Point-of-Delivery and District regulator.

b. local production stations that supply CDC facilities.

The Main Number Identifier System is a suggested method of assigning regulation numbers. To set this up, add the first five digits of the Main Number to the regulator identifier. The system appears as follows:

COMAKRXXX
(1) (2) (3)

(1) Company Number (CO).
(2) Market Number (MAK).
(3) RXXX is a Regulator identification sequential number to indicate the number of regulators in a market.

5. M & R DISTRIBUTION

5.1 M & R Request Design Drawing or "Station Design Memorandum" Distribution

Upon completion of a measuring and/or regulator design drawing or "Station Design Memorandum," Exhibit C, Facilities Planning will distribute copies (so that meters, regulators or other equipment may be reserved or secured) to:

a. District Operations Engineer.

b. Meter Shop.

c. Bangs, if appropriate.

5.2 Completed M & R Request Distribution

The completed M & R Request will be distributed by Engineering - Service Operations to:

a. Accounting, Tax and Risk Management - Gas Volume Accounting.

b. Accounting, Tax and Risk Management - Asset Accounting.

c. Engineering - Service Operations.

d. Engineering - Facilities Planning Volumetric Balancing System (VBS) Coordinator.

e. The appropriate District Operations Manager (or equivalent).

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/07/1994	**Measuring and /or Regulation Station Design Request**	Standard Number: **GS 2300.080(CG)** P&P 535-9
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EXHIBIT A

COLUMBIA GAS
Distribution Companies

MEASURING AND/OR REGULATION STATION DESIGN REQUEST

M-R NUMBER

IDENTITY

REQUEST FOR: ☐ MEASURING STATION NUMBER ASSIGNMENT ☐ ENGR.-FAC. PLAN. DESIGN REQUEST | DISTRICT | DATE REQUESTED

FACILITIES REQUIRED: ☐ MEASUREMENT ☐ REGULATION ☐ OTHER _____ | STATION WILL BE: ☐ NEW ☐ MODIFIED ☐ REPLACED

TYPE OF FACILITY:
☐ EXCHANGE STATION ☐ DUAL PURPOSE POD ☐ GMB ACCOUNT ☐ FPFM (Fixed Pressure Factor Metering)
☐ LOCAL PURCHASE ☐ DISTRICT REGULATOR ☐ CAB-GMB BILLING ONLY

CUSTOMER OR ACCOUNT NAME

STATION NAME

STREET NAME/RTE-ADDRESS | MUNICIPALITY/TOWNSHIP | COUNTY | STATE

MAIN (MARKET) NUMBER | PSID NUMBER | CUSTOMER REVENUE CLASS | TAX. DIST. NO. | COC MAP NUMBER | TCO MAP NUMBER

REQUESTED BY | TELEPHONE NUMBER: | DATE

DESIGN PRESSURE AND FLOWS

INLET (SOURCE OF GAS)	OUTLET (DELIVERIES INTO)
☐ TRANSMISSION-TCO ☐ TRANSMISSION-NON-AFFILIATE ☐ DISTRIBUTION ☐ PRODUCTION	☐ CUSTOMER FACILITIES ☐ DISTRIBUTION
PIPE SIZE _____	PIPE SIZE _____

NORMAL OPERATING PRESSURE RANGE:

	Maximum	Average	Minimum
Inlet (Psig)			
Outlet (Psig)			

Maximum Allowable Operating Pressure (MAOP)
Inlet Piping: _____ (Psig) Co. Outlet Piping _____ (Psig)

OPERATIONS ENGINEER: | VERIFICATION SIGNATURE: | TELEPHONE NUMBER: | DATE

FLOW DATA:

Hourly Flow (MCF)				
Future Hourly Flow (MCF)				Year_____

Daily Maximum: _____ MCF Daily Minimum: _____ MCF
Monthly Maximum: _____ MCF Monthly Minimum: _____ MCF
Average Yearly Flow: _____ MCF

Customer Max. Outlet Pressure Requirement _____ Psig

VERIFIED BY | TELEPHONE NUMBER: | DATE

OTHER DATA

ADDITIONAL COMMENTS:

A copy of the Operations Map reflecting the station location should be submitted with this request

FORM C 1459 CPS (10-92)

NiSource
Distribution Operations

Gas Standard

Effective Date: 07/07/1994	Measuring and /or Regulation Station Design Request	Standard Number: **GS 2300.080(CG)** P&P 535-9
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EXHIBIT B
(1 OF 2)

Columbia Gas Distribution Companies
Regulator Design Expert System
Design Number __
Page 1 of 3

* * * I D E N T I T Y   S E C T I O N * * *

District: ____________ Date: __/__/__
Station Will Be: _ New _ Modification _ Relocation of Existing Station

Type of Facility: _ Local Purchased/Self Help _ Exchange Station
_ Town Border _ District Regulator
_ GMB Meter Set Assembly _ Dual Purpose Pod

Customer or Account Name: ____________
Station Name: ____________
Station Location(street): ____________
Municipality/County Sub: ____________
County: ____________
State: ____ Tax District Number: ____________
CDC Map Number: ____________ Market Number: ____________
Station Number: ____________ PSID: ____________

Tab Key -> Next Field PF7 -> Previous Page PF8 -> Next Page
PF3 -> Save Data PF12 -> Exit Request Form Editor

Columbia Gas Distribution Companies
Regulator Design Expert System
Design Number
Page 2 Of 3

	Maximum	Average	Minimum	
Inlet (Psig)	____	____	____	
Outlet (Psig)	____	____	____	
Present Hourly Flow (MCF)	____	____	____	
Future Hourly Flow (MCF)	____	____	____	<- Year ____

Daily Maximum: ____ MCF Daily Minimum: ____ MCF
Monthly Maximum: ____ MCF Monthly Minimum: ____ MCF
Average Yearly Flow: ____ MCF

Maximum Allowable Operating Pressure (Psig) -
Inlet Piping: ____ Outlet Piping: ____ Customer Facilities: ____

Tab Key -> Next Field PF7 -> Previous Page PF8 -> Next Page
PF3 -> Save Data PF12 -> Exit Request Form Editor

Columbia Gas Distribution Companies
Regulator Design Expert System
Design Number __
Page 3 of 3

* * * A D D I T I O N A L   C O M M E N T S * * *

____
____
____
____

Requested By: ____________ Telephone: ____________

Tab Key -> Next Field PF7 -> Previous Page PF8 -> Next Page
PF3 -> Save Data PF12 -> Exit Request Form Editor

NiSource
Distribution Operations

Gas Standard

Effective Date: 07/07/1994	**Measuring and /or Regulation Station Design Request**	Standard Number: **GS 2300.080(CG)** P&P 535-9
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EXHIBIT B
(2 OF 2)

========== I D E N T I T Y ==========
Request Number:6201
District: Lake Erie Date Requested: 01/15/1993
Station Will Be: New
Type Of Facility Is: Local Purchase/Self Help

Customer Or Account Name: King Drilling
Station Name: Hawke Well
Station Location(street): Medina St.
Municipality/County Subdivision: Creston
County: Wayne Cust. Revenue Class: .
State: Oh Tax District Number: 0850100
CDC Map Number: 17-424-536-1 Market Number: 34327 (8559-2)
Station Number: 7-46283 PSID: N/A

========== P R E S S U R E S, F L O W S, A N D O T H E R D A T A ==========

	Maximum	Average	Minimum
Inlet (Psig)	100	35	20
Outlet (Psig)	5	4	4
Present Hourly Flow (MCF)	3	2	1
Future Hourly Flow (MCF)			<--

Maximum Daily Load: 36 MCF Minimum Daily Load: 12 MCF

Monthly Maximum Load:540 MCF Monthly Minimum Load: 180 MCF

Average Yearly Flow:4000 MCF

Maximum Allowable Operating Pressures (PSIG):
Inlet Piping: 100 Outlet Piping: 5 Customer Facilities:

Inlet(Source of gas): PRODUCTION | Outlet(Del. into): DISTRIBUTION
Line no.: LOCL-PRDUCER | Line no.: 34327001
Size(inches): 2 | Size(inches): 2

Velocity: 60 mph Measurement: Diaphragm
Type of regulators: Are The Same Location: Downstream
Bypass? No Pressure base: 14.65 (Ohio Contract)

========== A D D I T I O N A L C O M M E N T S ==========

Sizing for Hawke Well located at the intersection of Medina St.
and Euclid Ave. inside Creston Corp. Diaphragm meter requested
by King Drilling as they have several in stock.

Requested By: Rick Wilbert Telephone: 2163235551

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Gas Standard

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EXHIBIT C

STATION DESIGN MEMORANDUM

TO: E. C.Starkey

FROM: N. M. Bunag

DATE: October 12, 1992
PSID: 500220820
Map No: 0243-9
Station Number: 6-46101

SUBJECT: McKees Rocks Forgings Company, GMB Meter Set Assembly
McKees Rocks, Pa

STATION DESIGN DATA:

	Regulation	Measurement
Inlet Pressure	65.0 - 80.0 psig	65.0 - 80.0 psig
Outlet Pressure	10.0 psig	65.0 - 80.0 psig
MCF/Max. Hour	120.0 Mcfh	120.0 Mcfh
MCF/Min. Hour	10.0 Mcfh	10.0 Mcfh
Design Pressure	175.0 psig	175.0 psig
Min. Test Pressure	263.0 psig	263.0 psig
Min. Test Time	1 Hour	1 Hour

Measurement per Standard Drawing No. S-202, Topworks "B"

Meter Size	Manufacturer	Model No.	Working Pressure
6" FLG	Equimeter	T-30 ID	175.0 psig

Regulation per Standard Drawing No. S-106, Topworks "B"

Reg. Size, Func.	3" Monitor	3" Control
Manufacturer	Rockwell 441-57S	Rockwell 441-57S
ANSI Class,Matrl	125 FF Cast Iron	125 FF Cast Iron
Orifice Size	1 1/2	1 3/4
Stock Sym Number	48-07-020	48-07-022
Spring	Blue(7.5#-15#)	Blue(7.5#-15#)
Max Work Press	175.0 Psig	175.0 Psig
Assemble Press	175.0 Psig	175.0 Psig
Set Pressure	15.0 Psig	10.0 Psig

STANDARD METER RECORDING GAUGE SPECIFICATIONS
Mercury Instrument Company 12" pressure, volume, time and temperature, recorder model no. 1238. Gauge to be installed on the T-30 ID Equimeter meter with 100 cu. ft./revolution of the meter output drive, CCW rotation, Temperature well, stainless steel 4.0" insertion length.

Pressure range: 0 - 100 psig
1:1 basic gear train with 10:1 change ratio = 1,000 cu. ft./scallop per chart. Based on a monthly chart with 12 scallops per chart.
This is calculated on 60 Mcf/month @ 65.0 psig.

Actual cubic feet calculation:
60,000 X 14.73 /(14.73 + 65.00) = 11,084 cu.ft.

NOTES: 1. The capacity of the monitored regulation is 136.3 Mcfh with 65.0 Psig inlet and 10.0 Psig outlet.
2. The capacity of the meter is 162.4 Mcfh @ 65.0 psig.
3. Use CGS Number 1013 31 day universal meter chart.
4. Refer to standard drawing S-291 for the standard meter gauge tube fitting kit.
5. Install a 4" wafer check valve (Mission Duo) immediately after 4" inlet plug valve as shown in Standard Dwg. # 106, Setting D.

cc: R. T. Burrows, G. R. Cutler, J. P. Coulter, R. J. Kuhner, H. F. Rauch, R. A. Sutton, C. B. Jenkins, H. A. Keckley, J. E. Taylor

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Distribution Operations

Gas Standard

Effective Date: 07/07/1994	**Measuring and /or Regulation Station Design Request**	Standard Number: **GS 2300.080(CG)** P&P 535-9
Supersedes: N/A		Page 8 of 8

EXHIBIT D

REVENUE CLASS CODES

CODE	TYPE	DESCRIPTION
00	RES	RESIDENTIAL NON-HEAT
01	N/A	DEFAULT VALUE-DO NOT USE
11	COM	COMMERCIAL NON-HEAT
30	RES	RESIDENTIAL HEAT
31	COM	COMMERCIAL NGV
41	COM	COMMERCIAL HEAT
53	COM	INTRASTATE UTILITY SERV
60	RES	RESIDENTIAL A/C
61	COM	COMMERCIAL A/C
63	IND	INDUSTRIAL
64	IND	INDUSTRIAL DISTRIB - L P
65	IND	INDUSTRIAL TRANSMISSION
66	IND	INDUSTRIAL DISTRIB - OTHR
67	IND	INDUSTRIAL A/C
70	RES	RESIDENTIAL HEAT AND A/C
71	COM	COMMERCIAL HEAT AND A/C
77	COM	OTHER SALES
78	COM	MUTUAL ASSOCIATION
79	COM	FIELD SALES

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Distribution Operations

Gas Standard

Effective Date: 02/23/1987	**Compressor Stations**	Standard Number: **GS 2350.010(CG)** P&P 535-6
Supersedes: N/A		Page 1 of 1

Companies Affected:

☐ NIPSCO	☐ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☐ CPA

REFERENCE Code of Federal Regulations - Title 49 - Part 192 Columbia Gas Transmission Corporation - Policy and Procedure Manual - Operations

CDC owned compressor stations shall be designed, constructed, tested, operated and maintained in conformance with applicable Columbia Gas Transmission Company's (TCO) procedures.

Copies of TCO's procedures will be maintained at CDC owned compressor stations.

Particular attention shall be given TCO's Policy and Procedure - Operations - Chapter 2 - Registry 11 which insures that each compressor station:

a. Has a supplemental plan covering operating and maintenance procedures including preventative maintenance.
b. Is operated and maintained in conformance with the plan.
c. Operator keep records necessary to properly administer the plan.
d. Operator updates the plan from time to time as experience dictates.

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Distribution Operations

Gas Standard

Effective Date: 11/09/1994	**Joint Ownership Stations**	Standard Number: **GS 2380.040(CG)** P&P 535-3
Supersedes: N/A		Page 1 of 5

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL REQUIREMENT

For the purposes of this procedure, a joint ownership station is defined as being one of the following:

a. point of delivery (POD) station - measured
b. POD station - unmeasured
c. dual purpose station
d. exchange station
e. local production station

Ownership and Operation and Maintenance (O & M) responsibilities for all regulation/measurement and associated equipment at joint ownership stations shall be documented and maintained in the WMS Facility data base. See Exhibit A.

Whenever a new joint ownership station is built or reconstruction occurs that affects ownership, a joint survey investigation shall be made by local operating personnel to verify and document in the WMS Facility data base the ownership of facilities (property units) and O & M responsibilities. If the local personnel have any questions regarding ownership and/or O & M responsibility, Engineering - Facilities Planning should be contacted.

An isometric sketch indicating ownership of facilities (see Exhibit B) shall be placed in a protective cover inside the station. One isometric sketch shall be on file at the CDC operating location retaining such records and one sketch shall be furnished to the other company.

2. OPERATION AND MAINTENANCE RESPONSIBILITY

The company responsible for operating and/or maintaining equipment as indicated in the WMS Facility data base shall be responsible for scheduling and performing all the necessary tests and inspections in accordance with the ownership company's Policies and Procedures.

All operating and maintenance charges shall be made according to ownership. In cases where one company is operating and/or maintaining another company's facility, all time charges, equipment and materials shall be charged to the ownership company's appropriate account.

It is CDC's preference that regulators controlling pressure into CDC distribution piping be operated and maintained by CDC personnel regardless of ownership.

If the other company owns and intends to perform O & M activities on regulators controlling pressure into CDC distribution piping, notify Engineering - Facilities Planning. Facilities Planning will prepare and execute a maintenance agreement with the other company. Facilities Planning will also obtain annual certification from the other company that the facility is inspected, operated and maintained in accordance with 49 CFR Part 192 and any other applicable regulations and that it has not exceeded CDC's established MAOP.

3. RECORDS

The company responsible for operating and/or maintaining another company's facility, shall document details of all tests and inspections, and upon request, provide the owner with a copy.

The operator must be able to inform auditors or other interested personnel of the location of the test and inspection records.

Map corrections shall be made in accordance with GS 2610.040(CG) “Map Revisions."

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Distribution Operations

Gas Standard

Effective Date: 11/09/1994	**Joint Ownership Stations**	Standard Number: **GS 2380.040(CG)** P&P 535-3
Supersedes: N/A		Page 3 of 5

EXHIBIT A
(1 OF 2)

```
MC1B                    FACILITY INQUIRY - SELECTION LIST              08/29/94

LOCATION NUMBER:  1324
COUNTY:                    CITY:

S   FAC ID  TYPE STAT ----- LOCATED AT ----- --------- ALSO KNOWN AS ---------
  0000252011 VLV  E  5460 TRABUE RD R        INLET RUN 3
  0000252012 VLV  E  5460 TRABUE RD R        OUTLET RUN 3
x 0000252013 REG  E  5460 TRABUE RD R        MONITOR - RUN 1
  0000252014 REG  E  5460 TRABUE RD R        CONTROL - RUN 1
  0000252015 REG  E  5460 TRABUE RD R        MONITOR - RUN 2
  0000252016 REG  E  5460 TRABUE RD R        CONTROL - RUN 2
  0000252017 REG  E  5460 TRABUE RD R        MONITOR - RUN 3
  0000252018 REG  E  5460 TRABUE RD R        CONTROL - RUN 3
  0000252019 HTR  E  5460 TRABUE RD R        ENERTEK LINE HEATER
  0000252020 GAU  E  5460 TRABUE RD R        COMB. RECORDING GAUGE
  0000252021 VLV  E  5460 TRABUE RD R        20" EXTERIOR SHUTOFF
  0000252022 VLV  E  5460 TRABUE RD R        4" EXTERIOR BLOWOFF
  0000252023 CNT  E  5460 TRABUE RD R        MONITOR CONTROLLER - RUN 1

NEXT:      DATA:
PF1-HELP  PF2-MAIN MENU  PF3-RETURN  PF7-BACKWARD  PF8-FORWARD
```

```
MC1B                      FACILITY INQUIRY - HEADER                    08/29/94

FAC ID: 0000252013   FAC TYPE: REG    FUNCTION ID: 000018349   PSID:
CO PREM: 0408059    LAST UPDATED BY: D13PLTAW      DATE LAST UPDATE: 12/20/93
 LOCATED AT:  5460 TRABUE RD R
 BETWEEN:                                              LOC NUM: 1324
    AND:                                            *TCO LOC NUM:
  *COUNTY CODE: 049 *CITY CODE: COL  COLUMBUS          ZIP:
 *GAS PLT ACCT:          CPR ID:              PROP UNIT NO:          ID:
FAC STAT: E   SEQUENCE NUMBER: 00   RT(S) CREATED:  0   RT(S) REQUIRED:  0
 FACILITY ALSO KNOWN AS: MONITOR - RUN 1
  CO PREM ALSO KNOWN AS: ROME HILLIARD TOWN BORDER
    *MFG CODE: FH              MFG MODEL NUM: 8510 E DISC
DATE INSTALLED: 11/24/1992     INSTALLATION JO: 92-0137005-00
     TAX DIST: 0250010
    INC PLACE: COLUMBUS
 COUNTY SUBDIV:
 ASSESS DIST 1: COLUMBUS CITY (S.D.)
 ASSESS DIST 2:
   CDC MAP NUM: 7316424A          TCO MAP NUM:
NEXT:      DATA:
PF16-JO CREATE
```

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Distribution Operations

Gas Standard

Effective Date: 11/09/1994	**Joint Ownership Stations**	Standard Number: **GS 2380.040(CG)** P&P 535-3
Supersedes: N/A		Page 4 of 5

EXHIBIT A
(2 OF 2)

```
MC1B                        FACILITY INQUIRY - REGULATOR                08/29/94

 MFG CODE: FH      MFG MODEL NUM: 8510 E DISC            LOC NUM: 1324
 LOCATED AT:  5460 TRABUE RD R
 BETWEEN:                                  AND:
 ALSO KNOWN AS: MONITOR - RUN 1

       SERIAL NUMBER: 12286081     FUNCTION OF REGULATOR: MONITOR
      *TYPE CONTROLS: INSTRU                   SET POINT:  198.0 *UNIT: PSIG
         *INLET TYPE: FLANGE                 *INLET SIZE: 060
        *OUTLET TYPE: FLANGE                *OUTLET SIZE: 060
DESIGN PRESS OF BODY:  720.0 PSIG  DESIGN PRESS AS ASSEM:  720.0 PSIG
         *VALVE TYPE: DISC              *INNER VALVE SIZE: 999999
        *SPRING COLOR:                        SPRING RANGE:
*DIAPHRAGM CASE SIZE: 18                      *SEAT TYPE: SOFT
              OWNED BY: CDC             *DIS REGULATOR TYPE:
           OPERATED BY: COH
         MAINTAINED BY: COH
 REMARKS: REGULATOR '1A'. INNER VALVE SIZE 6".

 NEXT:       DATA:

 PF13-RELATED RT LIST  PF14-RELATED FACILITY LIST  PF15-JO HISTORY LIST
```

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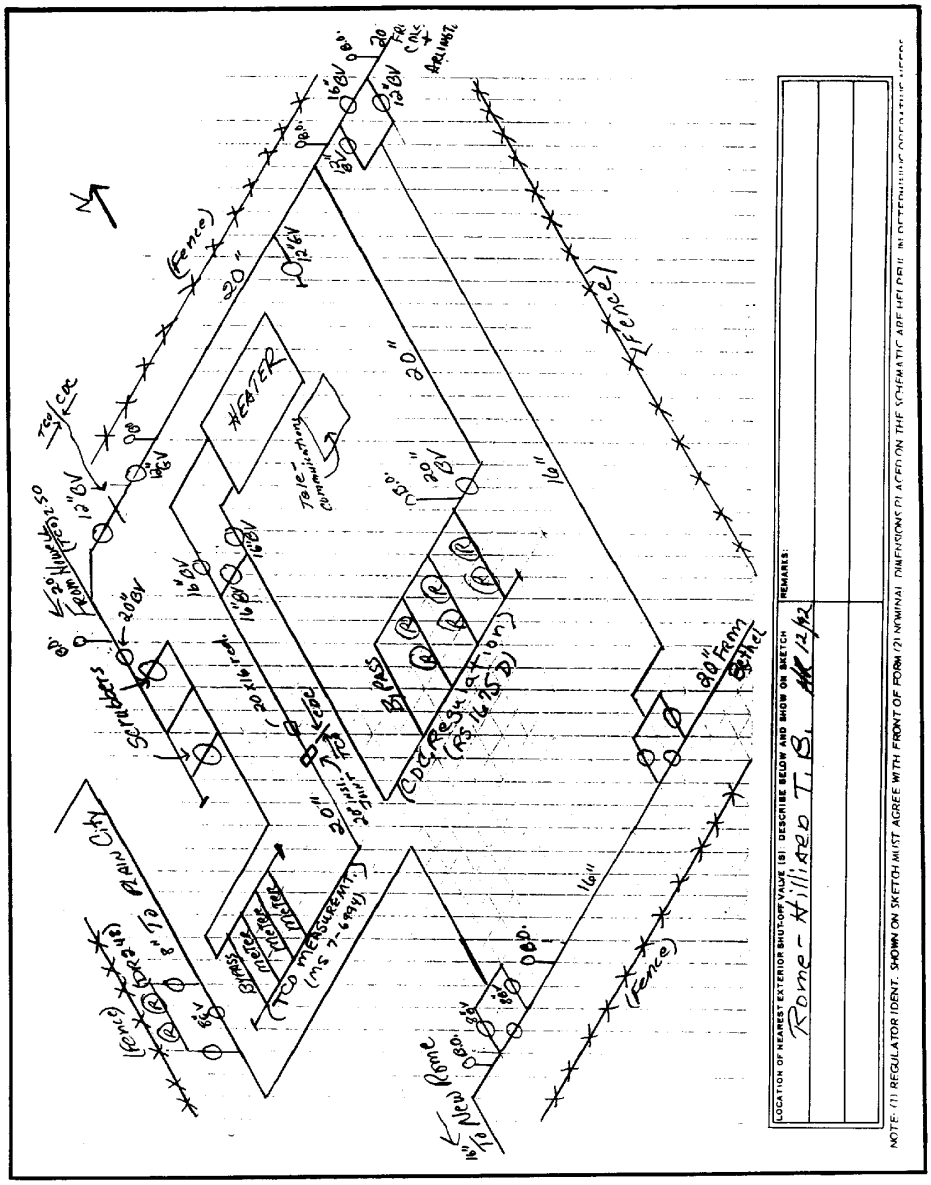
Distribution Operations

Gas Standard

Effective Date: 11/09/1994	**Joint Ownership Stations**	Standard Number: **GS 2380.040(CG)** P&P 535-3
Supersedes: N/A		Page 5 of 5

EXHIBIT B



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Gas Standard

Effective Date: 07/01/2010	**Critical Valve Design Guidelines**	Standard Number: **GS 2400.010(KY)**
Supercedes: N/A		Page 1 of 7

Companies Affected:

☐ NIPSCO	☐ CGV ☐ COH	☐ BSG
☐ NIFL	☑ CKY ☐ CPA	
☐ Kokomo Gas	☐ CMD	

REFERENCE 49 CFR Part 192.181

1. GENERAL

The purpose of this standard is to provide guidance to Engineering and Field Operations on the development of an effective critical valve (also known as emergency valve) program for transmission lines and distribution mains. The intent of this program is to ensure the identification and location of critical valves and to show that they are designed to sectionalize a specific area of the system. The periodic review of the critical valve program is necessary to ensure adequate system sectionalization in the event of an emergency. This document provides guidance to responsible personnel on the design and designation of critical valves.

Critical valves in distribution systems are valves owned and designated by the Company, the use of which may be necessary for the safe operation of the system.

Critical valves for transmission lines are valves that are owned and designated by the Company that might be required during any emergency.

Valves that are not owned by the Company shall not be designated as critical valves, with the following exception. If the Company has a formal agreement (e.g., agreement outlining operating and maintenance responsibilities) with the owner of the valve(s), then the Company may choose to designate such valve(s) as critical.

Valves, in general, are commonly used to:

a. shut off the flow of gas if there is an imminent threat to life or property,
b. control the re-pressurization of the system during outages,
c. re-direct flow and isolate areas during supply emergencies,
d. shut off the flow of gas to a regulator station in case of fire or blowing gas due to equipment failure, or
e. isolate a large section of a high pressure or a medium pressure looped system.

2. DESIGN

Valves, except those in regulator settings or bypasses around regulator stations, shall not be used to separate piping systems unless blind plated or operating at the same maximum operating pressure (MOP). Refer to GS 1660.020 "Maximum Allowable Operating Pressure (MAOP)" for information regarding MOP.

Each critical valve installed on a distribution main must comply with the following:

a. The valve must be placed in a readily accessible location so as to facilitate its operation in an emergency.

b. The operating stem or mechanism must be readily accessible.

c. If the valve is installed in a buried box or enclosure (e.g., concrete pit or vault), the box or enclosure must be installed so as to avoid transmitting external loads to the main.

It is recommended that new or replacement buried valves have a non-lubricating feature and a 2 inch square standard operating nut size, so that a common valve key can be used to operate the valve.

Refer to GS 2400.020 "Transmission Line Valve Design Requirements" for additional design requirements for transmission line valves.

3. CRITICAL VALVE DESIGNATION CRITERIA

The following Company owned valves shall be designated as critical valves:

a. inlet regulator station exterior shut-off valves (refer to Section 3.1 for additional guidance),

b. outlet regulator station exterior shut-off valves (refer to Section 3.1 for additional guidance),

c. isolation valves on distribution piping systems that are not operating at low pressure (refer to Section 3.2 for additional guidance), and

d. sectionalizing block valves and blowdown valves on Company owned transmission lines (refer to Section 3.3 for additional guidance).

3.1 Inlet Regulator Station Exterior Shut-Off Valves

Each regulator station controlling the flow or pressure of gas in a distribution system shall have valves installed on the inlet and outlet piping at a distance from the regulator station sufficient to permit the operation of the valve during an emergency that might preclude access to the station. The outlet piping critical valve is also designed to prevent backfeeding in case of an emergency that might preclude access

to the station. Regulator stations installed prior to August 19, 1970 are exempted from this requirement. However, capital design work planned for a new or replacement regulator station or the inlet and/or outlet piping shall include the design of critical valves meeting the sufficient distance requirements indicated below.

In Kentucky, if the inlet pressure to the station is 100 psig or less, the valves shall be located a minimum of 40 feet from the regulator station. If the inlet pressure is more than 100 psig, the valves shall be located a minimum of 100 feet from the regulator station.

At a point of delivery (POD), the inlet valve to the regulator station or distribution system may be owned by the supplier or the Company. If this inlet valve is owned by the supplier, then it is not required to be designated as critical by the Company.

The design of a complete new or replacement POD shall consider the installation of a Company owned critical valve on the inlet piping to the POD, in addition to the supplier owned valve, if there is sufficient space to permit the operation of a Company owned critical valve during an emergency that might preclude access to the POD.

NOTE: If space limitations exist, or if the POD station design prevents the installation of a Company owned critical valve in addition to a supplier owned valve, then a critical valve shall be designed on the outlet piping of the station at a distance sufficient to permit the operation of the valve during an emergency that might preclude access to the station.

3.2 Isolation Valves

Valves deemed necessary to sectionalize distribution piping systems that are not operating at low pressure shall be designated as “critical” valves. The critical valves shall be located so as to reduce the time necessary to shut down an area in an emergency. The operating pressure, size of main, number of customers, and local conditions should be considered to determine locations of the critical valves. The areas of isolation should be sized to allow for reestablishing service to the customers within a 24-hour period after restoration of system pressure (with the exception of customer premises that are inaccessible). Shorter relight time periods may be considered due to local conditions, such as typical cold weather temperatures, remote locations, etc. Such isolation areas will enable manageable areas to be isolated in the event of a large outage, and thereby would allow a system to be re-pressurized in sections.

Determination of how many customers can be restored within a certain time period is dependent upon the service territory and how many qualified personnel are readily available. The time it takes for a single service person to restore service to a number of homes/residences per hour depends on several factors including, but not limited to, the number of meters associated with a service line (manifolds), ability to gain access, and the number of appliances to check.

It is recommended that Engineering work with Field Operations (e.g., Integration Center) to determine the number of personnel available for a working shift (including assistance from adjacent operating areas, etc.) and the average rate of service restoration based on geographic location.

3.3 Transmission Line Sectionalizing Block and Blowdown Valves

The requirements for sectionalizing block valves and blowdown valves on transmission lines are provided in GS 2400.020 "Transmission Line Valve Design Requirements." Additional sectionalizing block valves and blowdown valves beyond the requirements of GS 2400.020 are not required to be designated as critical valves.

4. OTHER OPTIONAL CRITERIA

The following Company owned valves should be considered for designation as critical valves:

a. regulator station exterior bypass valves,

b. valves supplying distribution piping systems or Company owned transmission lines, where no regulator station exists, and/or

c. valves separating sources of supply or storage, peak shaving plants, and LNG plants from distribution systems or Company owned transmission lines.

5. RECLASSIFICATION OF CRITICAL VALVES

5.1 From Critical to Non-Critical

If an existing critical valve is determined to be non-critical, Field Operations or Engineering shall document the decision, and the decision shall be approved by the local Field Engineering Leader. The documentation should address:

a. the type of area(s) and/or customers that the valve controls (e.g., residential, commercial, industrial);

b. predominant surface type over the pipeline in the area (e.g., grass, asphalt, concrete);

c. justification for the reclassification; and

d. which valve(s) will be used to control the flow of gas.

See Exhibit A for an example of a valve reclassification document. The format of the documentation and approval can be accomplished via e-mail.

Engineering shall forward a copy of the approved reclassification document to Field Operations (e.g., local operating center manager and/or front line leader/supervisor).

Field Operations shall complete the following, with help from Engineering, as appropriate.

e. Remove the valve tag or change the valve tag in the field to the appropriate designation, whichever is applicable based on local operations.

f. Create a map/GIS correction (or equivalent process) to identify the appropriate valve designation.

g. Record the applicable information on the Company's existing valve form and within the Company's WM/GIS or equivalent.

h. Remove the valve documentation from the Company's critical valve plan or book and from the critical valve inspection schedule.

i. Ensure that the updated valve information is distributed to appropriate personnel to update their records.

5.2 From Non-Critical to Critical

If Field Operations or Engineering decides to designate a non-critical valve as critical, Field Operations shall complete the following, with help from Engineering, as appropriate.

a. Verify that the valve is accessible and operable in the field.

b. Obtain the necessary field measurements and other pertinent information regarding the valve.

c. Tag the valve in the field with the appropriate designation.

d. Prepare a sketch and/or create a map/GIS correction (or equivalent process) to identify and describe the location and function of the valve.

e. Record the applicable information on the Company's existing valve form and within the Company's WM/GIS or equivalent.

f. Take the necessary steps to ensure that the valve documentation is placed in the Company's critical valve plan or book and on the critical valve inspection schedule.

g. Ensure that the valve information is distributed to appropriate personnel to update their records.

6. RECORDS

Each operations center must maintain a complete, up-to-date set of maps detailing the distribution network. In addition, each operations center must maintain a list of critical valves. A sketch, map or other means of identifying and describing the location of the valve, the function of the valve (e.g., controls the flow into regulator station abc), and other pertinent information must also be maintained. The Company's existing valve forms shall be

used for documentation.

Until the Company Geographical Information System (GIS) is fully implemented, existing critical valve isolation drawings shall continue to be maintained by Engineering.

Critical valves on distribution mains and transmission lines shall also be identified on operations maps/GIS.

7. REVIEW

A continuous review of system growth, tie-ins, and new valve installations is necessary in order to maintain a reliable critical valve program. Special consideration shall be given to areas of growth and significant capital work.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2010	**Critical Valve Design Guidelines**	Standard Number: **GS 2400.010(KY)**
Supercedes: N/A		Page 7 of 7

EXHIBIT A

Intercompany Communication

To: John Doe, Field Engineering Leader
From: Sam Smith, Field Engineer
Date: January 2, 2009
Subject: Reclassification of Critical Valve C-1111, located at the intersection of Main Street and Town Street in Anytown, and found on Map #1234-A

The subject critical valve is not necessary for the safe operation of this system and does not meet the requirements of a critical valve as specified in GS 2400.010. Reclassification is justified because this valve controls a small section of plastic piping that supplies a residential/light commercial area. The downstream pipeline is 6-inches or less, lies mostly in grass, and does not supply a high growth area.

Critical valves C-1110 and C-1000 will be used to control the flow of gas to the area.

Based on a review of the applicable information, I recommend that the valve identified above be reclassified as non-critical.

Once approved, the applicable map correction will be submitted, the necessary adjustments will be made to the facility and the repetitive task in the work management system, the critical valve maps will be updated, the valve tag will be removed in the field, and the valve books will be updated.

Approval:

_____ _____
Field Engineering Leader Date

cc: Joe Jones, Operating Center Manager
Tom Thompson, Front Line Leader/Supervisor
Maps & Records w/ map correction

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2010	**Transmission Line Valve Design Requirements**	Standard Number: **GS 2400.020**
Supercedes: N/A		Page 1 of 3

Companies Affected:			
☐ NIPSCO	☑ CGV	☑ COH	☐ BSG
☐ NIFL	☑ CKY	☑ CPA	
☐ Kokomo Gas	☑ CMD		

REFERENCE 49 CFR Part 192.179

1. GENERAL

The purpose of this standard is to provide the minimum requirements for the design of critical valves in **transmission line**s. Refer to GS 2400.010 "Critical Valve Design Guidelines" for general design guidelines.

2. DESIGN REQUIREMENTS

2.1 Sectionalizing Block Valves

Each transmission line must have sectionalizing block valves spaced so that any point on the pipeline is within the distance indicated in Table 1.

Table 1

Transmission Line Sectionalizing Block Valve Distance Requirements	
Class Location	Maximum Distance from any Point on the Pipeline to a Valve
4	2 ½ miles
3	4 miles
2	7 ½ miles
1	10 miles

For example, in a Class 4 location, sectionalizing block valves shall be spaced no greater than 5 miles apart, so that any point on the pipeline is within 2 ½ miles.

Each sectionalizing block valve and the operating device to open or close the valve must be readily accessible and protected from tampering and damage.

Each sectionalizing block valve must be supported to prevent settling of the valve or movement of the pipe to which it is attached.

Full-ported valves are required for use as sectionalizing block valves to accommodate the passage of internal inspection devices (i.e. “smart pigs”). Full-ported ball valves with extensions for above ground wheel operators are recommended.

See Exhibit A for an example of a sectionalizing block valve design.

2.2 Blowdown Valves

Each section of a transmission line, between mainline valves, must have a blowdown valve with enough capacity to allow the transmission line to be blown down as rapidly as practicable.

Each blowdown discharge must be located so that gas can be blown to the atmosphere without creating a hazard. Discharging shall not be into the electrical conductors of overhead electric lines.

Blowdown valve designs shall include permanent facilities located above ground.

See Exhibit A for an example of a blowdown valve design.

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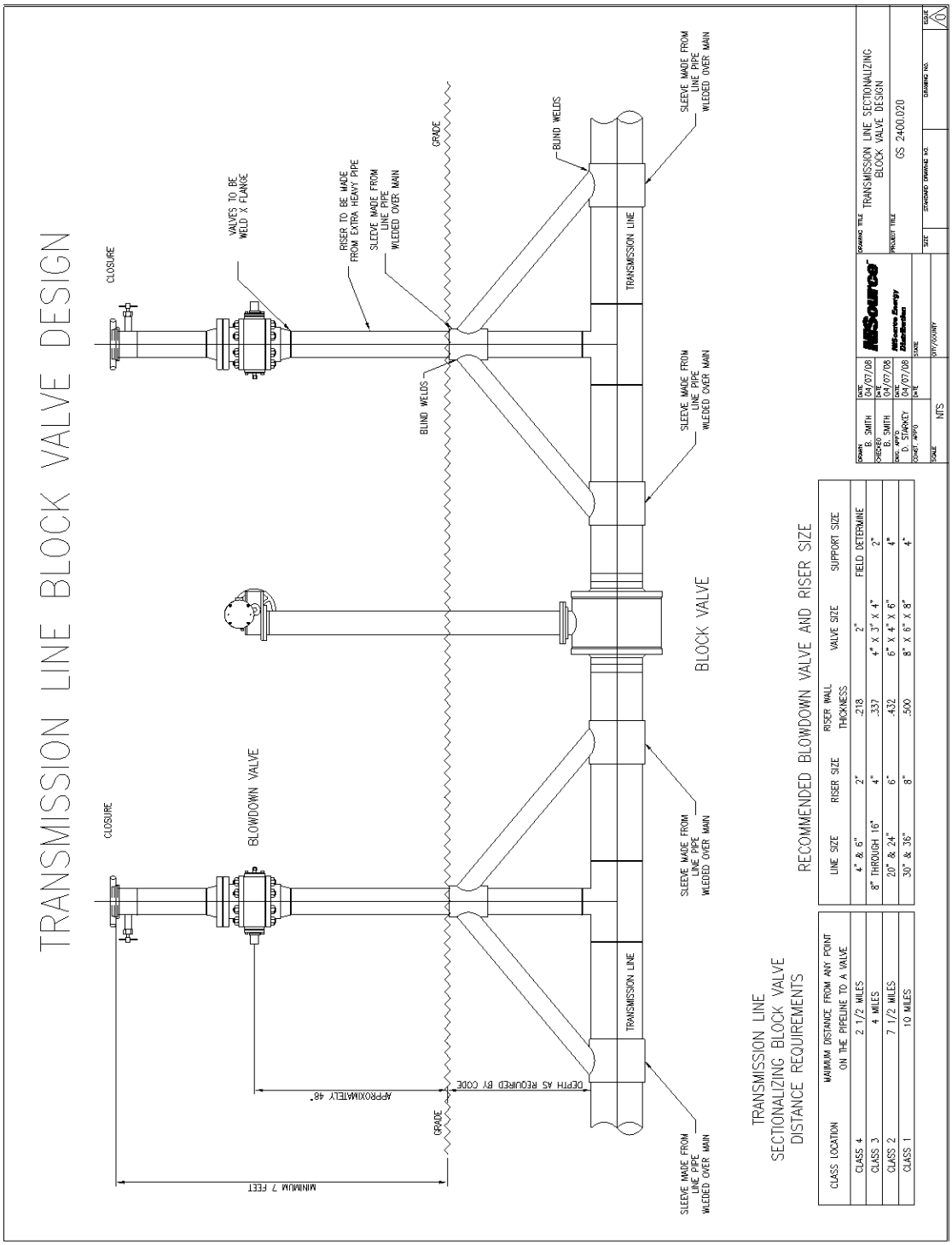
Distribution Operations

Gas Standard

Effective Date: 07/01/2010	**Transmission Line Valve Design Requirements**	Standard Number: **GS 2400.020**
Supercedes: N/A		Page 3 of 3

EXHIBIT A



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Distribution Operations

Gas Standard

Effective Date: 02/12/1999	**Reinforcement Requirements for Steel Pipe Branch Connections**	Standard Number: **GS 2420.010(CG)** P&P 530-9
Supersedes: N/A		Page 1 of 8

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE Code of Federal Regulations - Title 49 - Part 192 - Subpart D - § 192.155

1. DEFINITION

For the purpose of this procedure a branch (lateral) connection is any connection made perpendicular to the axis of the pipe that necessitates making a hole in the pipe wall.

2. GENERAL

Situations will be encountered where a branch connection from steel mains will be required. This requires an engineering decision as to whether reinforcement is necessary.

3. REINFORCEMENT

To assist in the decision as to whether reinforcement is required, the following guidance is provided:

a. For new or replacement mains, branch connections shall be made with one of the following manufactured fittings: inline tee, spherical tee, or 3-way tee.

b. For branch connections from existing mains 24 inches or less and operating at 60 psig or less, no reinforcement is required unless abnormal secondary stresses are present.

c. For branch connections from existing mains 12 inches or less and operating at 125 psig or less, no reinforcement is required unless abnormal secondary stresses are present.

d. Branch connections from existing mains meeting any one of the following criteria may require reinforcement:

   1. operating above 125 psig.
   2. larger than 12 inches below 125 psig, or
   3. less than 12 inches below 125 psig and above 60 psig with abnormal secondary stress levels.
   4. less than 24 inches below 60 psig with abnormal stress levels.

Note: Exhibits A and B have been prepared to provide necessary guidance. The Tables are based on Exhibit C.

e. Where two or more branch connections are required, field fabricated branch connections shall be separated by not less than three (3) pipe diameters (centerline to centerline) of the largest size branch pipe.

4. SECONDARY STRESS AREAS

Abnormal secondary stress level is normally associated with areas where:

a. Vibration is constantly or periodically encountered. Examples: railroads, heavy traffic areas, immediate piping around a major pressure reduction station.

b. Soil conditions are unstable or abnormal frost heaving is experienced or anticipated.

c. Thermal contraction is a factor, as in aboveground piping.

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Distribution Operations

Gas Standard

Effective Date: 02/12/1999	**Reinforcement Requirements for Steel Pipe Branch Connections**	Standard Number: **GS 2420.010(CG)** P&P 530-9
Supersedes: N/A		Page 3 of 8

EXHIBIT A
(1 of 2)

Branch Connection Reinforcement Reference - 125 psig Design

Pipe Header Code:

a - Area required (AR), b - Maximum reinforcement thickness (M), c - Maximum reinforcement width (2d), d - Special conditions - See Reinforcement Codes below Table.

Branch Diameter, Nominal Size, Inches

Pipe Header Diameter, Nominal Size, Inches

		1 1/4	2	3	4	6	8	10	12	16	20	24
1 1/4	a b c d	None→										
2	a b c d	←None→										
3	a b c d	←None→										
4	a b c d	←None→										
6	a b c d	←None→										
8	a b c d	←None→										
10	a b c d	←None→										
12	a b c d	←None→										
16	a b c d	←None→			.019 .274 8.5 B	.098 .274 12.6 B	.180 .274 16.5 A	.234 .274 20.7 A	.348 .274 24.7 A	.479 .274 31.1 A		
20	a b c d	←None→		.066 .313 6.5 C	.142 .313 8.5 C	.279 .313 12.6 B	.429 .313 16.5 B	.587 .313 20.7 A	.737 .313 24.7 A	.977 .313 31.1 A	1.281 .313 39.0 A	
24	a b c d	←None→		.294 .313 6.5 C	.434 .313 8.5 C	.705 .313 12.6 B	.981 .313 16.5 B	1.273 .313 20.7 B	1.549 .313 24.7 A	2.018 .313 31.1 A	2.556 .313 39.0 A	3.11 .313 47.0 A

Table based on minimum pipe wall thickness and Grade B material.

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Distribution Operations

Gas Standard

Effective Date: 02/12/1999	**Reinforcement Requirements for Steel Pipe Branch Connections**	Standard Number: **GS 2420.010(CG)** P&P 530-9
Supersedes: N/A		Page 4 of 8

EXHIBIT A
(2 of 2)

Reinforcement Codes:

A. Smoothly contoured wrought steel tees of proven design are preferred. When tees cannot be used, the reinforcing member shall extend around the circumference of the header. Pads, partial saddles, or other types of localized reinforcement are prohibited.

B. Smoothly contoured tees of proven design are preferred. When tees are not used, the reinforcing member should be of the complete encirclement type, but may be of the pad type, or saddle type.

C. The reinforcement member may be of the complete encirclement type, pad type, or saddle type. The edges of reinforcement members should be tapered to the header thickness. It is recommended that legs of fillet welds joining the reinforcing member and header do not exceed the thickness of the header.

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Gas Standard

Effective Date: 02/12/1999	**Reinforcement Requirements for Steel Pipe Branch Connections**	Standard Number: **GS 2420.010(CG)** P&P 530-9
Supersedes: N/A		Page 5 of 8

EXHIBIT B
(1 of 2)

Branch Connection Reinforcement Reference - 250 psig Design

Pipe Header Code:

a - Area required (AR), b - Maximum reinforcement thickness (M), c - Maximum reinforcement width (2d), d - Special conditions - See Reinforcement Codes below Table.

Branch Diameter, Nominal Size, Inches

Pipe Header Diameter, Nominal Size, Inches

		1 1/4	2	3	4	6	8	10	12	16	20	24
1 1/4	a	None→										
	b											
	c											
	d											
2	a	←None→										
	b											
	c											
	d											
3	a	←None→										
	b											
	c											
	d											
4	a	None→	.059	.117	.166							
	b		.156	.156	.156							
	c		4.13	6.5	8.5							
	d		H-I	H-I	H-I							
6	a	None→	.002	.047	.087	.169						
	b		.195	.195	.195	.195						
	c		4.13	6.5	8.5	12.6						
	d		H-I	H-I	H-I	H-I						
8	a	None→	.096	.20	.288	.471	.645					
	b		.215	.215	.215	.215	.215					
	c		4.13	6.5	8.5	12.6	16.5					
	d		H-I	H-I	H-I	H-I	H-I					
10	a	←None→		.354	.492	.776	1.046	1.335				
	b			.235	.235	.235	.235	.235				
	c			6.5	8.5	12.6	16.5	20.7				
	d			H-I	H-I	A	A	A				
12	a	←None→		.511	.698	1.083	1.452	1.843	2.711			
	b			.253	.253	.253	.253	.253	.253			
	c			6.5	8.5	12.6	16.5	20.7	24.7			
	d			H-I	H-I	A	A	A	A			
16	a	←None→		.765	1.026	1.56	2.072	2.617	3.13	3.95		
	b			.274	.274	.274	.274	.274	.274	.274		
	c			6.5	8.5	12.6	16.5	20.7	24.7	31.1		
	d			H-I	H-I	H-I	A	A	A	A		
20	a	←None→		.98	1.306	1.969	2.611	3.293	3.935	4.964	6.268	
	b			.313	.313	.313	.313	.313	.313	.313	.313	
	c			6.5	8.5	12.6	16.5	20.7	24.7	31.1	39.0	
	d			H-I	H-I	H-I	H-I	A	A	A	A	
24	a	←None→		1.23	1.62	2.42	3.19	4.01	4.78	6.02	7.58	9.15
	b			.313	.313	.313	.313	.313	.313	.313	.313	.313
	c			6.5	8.5	12.6	16.5	20.7	24.7	31.1	39.0	47.0
	d			H-I	H-I	H-I	H-I	H-I	A	A	A	A

Table based on minimum pipe wall thickness and Grade B material.

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Distribution Operations

Gas Standard

Effective Date: 02/12/1999	**Reinforcement Requirements for Steel Pipe Branch Connections**	Standard Number: **GS 2420.010(CG)** P&P 530-9
Supersedes: N/A		Page 6 of 8

EXHIBIT B
(2 of 2)

Reinforcement Codes:

A. Smoothly contoured wrought steel tees of proven design are preferred. When tees cannot be used, the reinforcing member shall extend around the circumference of the header. Pads, partial saddles, or other types of localized reinforcement are prohibited.

H. If a reinforcement member is required, and the branch diameter is such that a localized type of reinforcement member would extend around more than half the circumference of the header, then a complete encirclement type of reinforcement member shall be used, regardless of the design hoop stress; or a smoothly contoured tee may be used.

I. The reinforcement may be of any type meeting the requirements of Exhibit D.

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Distribution Operations

Gas Standard

Effective Date: 02/12/1999	**Reinforcement Requirements for Steel Pipe Branch Connections**	Standard Number: **GS 2420.010(CG)** P&P 530-9
Supersedes: N/A		Page 7 of 8

EXHIBIT C

Calculation for Branch Re-Enforcement

A_R = (d) (t)

A_A = $A_1 + A_2 + A_3$

A_1 = (H-t) d

A_2 = 2 ($B-t_b$) L

A_3 = Summation of the cross sectional area of all added reinforcement, including weld areas which lie within the "Area of Reinforcement"

A_A must be equal to or greater than A_R

Where:

A_R = Reinforcement area required

A_A = Area available as reinforcement

H = Wall thickness of header

B = Wall thickness of branch

t = Required wall thickness of header

t_b = Required wall thickness of branch

d = The length of the finished opening in the header wall (measured parallel to the to the axis of the header)

M = Measured thickness of added reinforcement

L = The smaller of (2½ H) or (2½ B + M)

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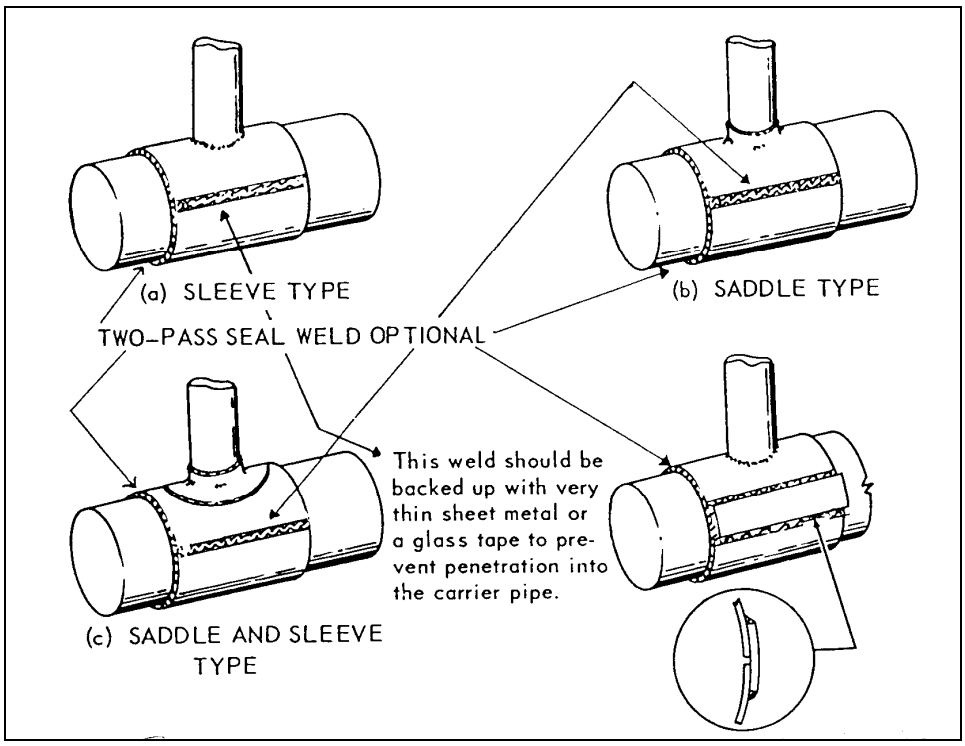
Distribution Operations

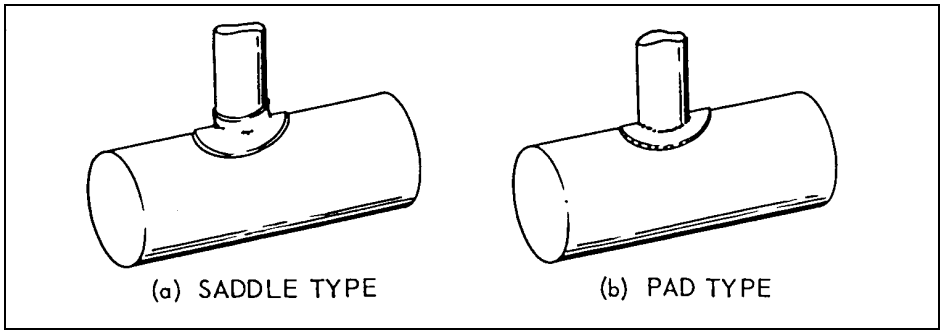
Gas Standard

Effective Date: 02/12/1999	**Reinforcement Requirements for Steel Pipe Branch Connections**	Standard Number: **GS 2420.010(CG)** P&P 530-9
Supersedes: N/A		Page 8 of 8

EXHIBIT D



COMPLETE ENCIRCLEMENT TYPES OF REINFORCEMENT



LOCAL TYPES OF REINFORCEMENT

NOTE: Refer to NDO Welding Manual for instructions regarding welding of branch connections.

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Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Map Features**	Standard Number: **GS 2610.010(CG)** P&P 550-1
Supersedes: N/A		Page 1 of 15

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

The symbols and mapping features in this Procedure are intended only to reflect those that are being used, since Columbia's restructuring (April 1, 1973).

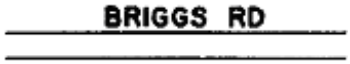
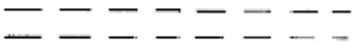
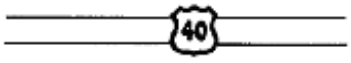
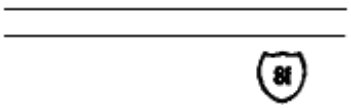
Symbols and mapping methods used by the former group companies prior to restructuring will still appear on maps until all are revised. Areas using unrevised maps must remain familiar with past mapping practices. Information pertaining to the former mapping systems is available from the Graphics Section of the Engineering Department.

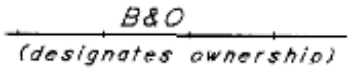
A new map base has been adopted for a more uniform system throughout the CDC operating territory. The map grid is based on the Universal Transverse Mercator System as utilized by the United States Geological Survey Department. The system has been adopted to produce uniform size maps, a uniform map base, eventual conversion to a computer graphics system, and is readily convertible to the metric scale.

2. TAXING DISTRICT LINE SYMBOLS

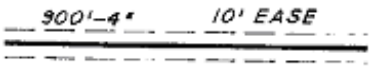
ITEM	SYMBOL
Corporation Line	
State Line	
County Line	
School District	
Township Line or Magisterial District Line	
Fire Levy District	

3. ROADWAYS

ITEM	SYMBOL
Road R/W showing Street Name (On Highway Interchanges, mobile homes and apartment complexes paving lines may be shown for clarification.)	
Dedicated Road (not paved or used) Vacated Road Utility Easement	
County Road (No. 25)	C-25
Township Road (No. 3)	T-3
State Highway (No. 23)	
United States Highway (No. 40)	
U. S. Interstate Highway (No. 81)	
Symbol Location, On Maps, 1" = 800'	
Symbol Location, On Maps, Other	
Legislative Routes (CPA only)	S R 28380
Tourists Routes	S R 362

ITEM	SYMBOL
Railroad, Single Track	

4. PIPE LOCATION IN ROADWAYS AND EASEMENTS

ITEM	SYMBOL
Utility Easement Showing Gas Pipeline	
Distance shown from centerline of paved or traveled portion	
Distance shown from property lines in locations where property lines are easily determined in the field.	

5. DESIGNATION OF GAS PIPELINE TYPES

ITEM	SYMBOL	
	Old Method	New Method
Cast Iron C.I.	CI	
Cast Iron Bell & Spigot C.I.B.S	CI	
Cast Iron Matheson Joint C.I.M.J	CIMJ	
Cast Iron Doublex Simplex C.I.S.D	CISD	CIMJ
Copper Tubing ------	CT	
Conduit (Casing) with Filler ------	CF	
Double Random Length Coupled D.R.L.C.	DRLC	MJ

ITEM	SYMBOL	
	Old Method	New Method
Dresser 700 Fittings C.D.Tr.	MJ	
Galvanized	Galv.	Galv.
Galvanized Welded Galv. Wld.	GW	
Mechanical Joint M.J.	MJ	
Pipe Used For Casing Csg.	C	
Pipe Used For Conduit Cond.	C	
Pipe, Plain End P.E.	MJ	
Pipe, Plain End Coupled P.E.C.	MJ	
Pipe, Plain End Treated P.E.Tr.	MJT	
Pipe, Plain End Welded P.E.Wld.	PEW	W
Pipe, Plain End Weld Treated PEWT	WT	
Pipe, Plastic, Unknown Type --	P	
Pipe, Plastic (Medium Density Polyethylene) P.P.	PM	
Pipe, Plastic (Aldyl "A") Plas.	PA	
Pipe, Plastic (High Density Polyethylene) PD	PH	
Pipe, Plastic, Acrylonitrile Butadiene Styrene T-IA.B.S.	T-IA.B.S.	
Pipe, Plastic, Polyvinylcloride --	PVC	
Pipe, Red Thread Fibre Glass --	RTF	
Pipe, Screw (Note: Whenever type pipe is unknown assume screw steel pipe)	No Symbol Used	No Symbol Used
Pipe, Screw Treated Tr.	T	
Pipe, Welded Wld	W	
Pipe, Welded Treated Wld. Tr.	WT	
Pipe, Wrought Iron W.I.	WI	
Pipe, Wrought Iron (Converse Hub) W.I.C.H.	WICH	WIMJ

ITEM	SYMBOL	
	Old Method	New Method
Pipe, Wrought Iron (Matheson Joint) W.I.M.J.	WIMJ	WIMJ
Pipe, Wrought Iron (Plain End) W.I.P.E.	WIPE	WIMJ
Pipe, Wrought Iron (Universal Joint) W.I.U.J.	WIUJ	WIMJ
Pipe, Wrought Iron Welded W.I.Wld	W I W	
Screw Tubing Tub.		No Symbol Used
Vent Pipe Vent	V	

NOTE: MJ = Mechanical Joint

6. PRESSURE DESIGNATIONS

ITEM	SYMBOL	
	MAP SCALE	
	1" = 200'	1" = 800'
Low Pressure Pipeline -	LP	
Intermediate Pressure Pipeline IP	IP	
Medium Pressure Pipeline MP	MP	
High Pressure Pipeline HP	-	

7. MISCELLANEOUS PIPELINE SYMBOLS

ITEM	SYMBOL
Tick mark - Indicates different time of construction, type, kind, or changes in measurements	
Reducer - indicates change in size	

MiSource
Distribution Operations

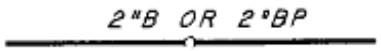
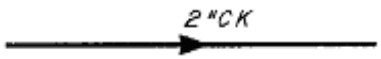
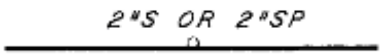
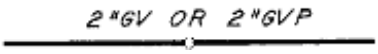
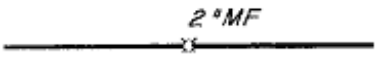
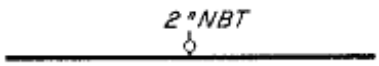
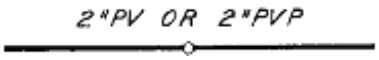
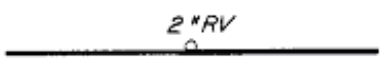
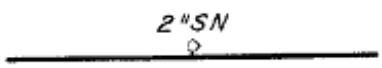
Gas Standard

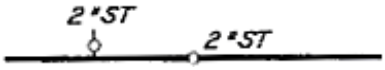
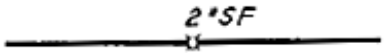
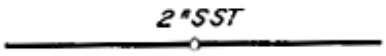
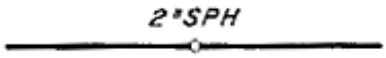
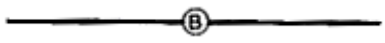
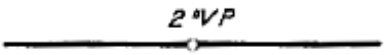
Effective Date: 07/20/1994	**Map Features**	Standard Number: **GS 2610.010(CG)** P&P 550-1
Supersedes: N/A		Page 6 of 15

ITEM	SYMBOL
Fittings	FTGS
Gas Flow (Used in Details Only)	7'-4"WT
Building Numbers (Actual Building not shown)	B-3750
Job Order Number and Year of Main Installation	5678 / 93
Date of Main Installation	235'-2" 2'-2"P 2'-2"P 438'-2" 3'-2"P 8'-2"P 5'-2"P
Foreign (Abrev. Name) and Private (Pvt)	(designate owner, type, & size)
Service Lines Company-Owned Less Than 3"	(size, ser) 2"SER
Drip	DRIP
Distribution "D Lines"	D-74
Pipe amounts are shown in brackets when the identical quantity and portion of line is shown elsewhere on that map, supplemental map, or an adjacent map.	(234')-8"
Reclaimed Pipe (Reused Abandoned Pipe) RC-Original Install Year; i.e. RC-60	220'-4"WTMP (RC-60)
Riser Pipe in Main (Plan View)	5'-2"WTMPR
Drain Line from Drip to Storage Tank	(1100'-2") D D
Propane Symbol	575'-2"WT PRO

8. VALVE AND FITTING DESIGNATIONS

These symbols are to be mapped so that they indicate whether they control "lateral" flow (such as a Continental Tee) or "in line" flow (such as a gate valve or Shortstopp fitting) or both lateral and "in line" flow (such as a Shortstopp tee). The correct mapping of these fittings is a helpful guide as to the equipment needed to operate the fitting.

ITEM	SYMBOL
Automatic Valve	
Ball Valve	
Blow Off	
Check Valve (Arrow indicates Gas Flow)	
Continental Tee Shut Off Tee Drisco Branching Tee (Self Tapping)	
Gate Valve	
Mueller Fitting	
No-Blow-Tee, Mueller Tee or Mueller Valve Tee (Pin-off Tee)	
Plug Valve	
Relief Valve	
Safety Nipple	
Shortstopp Welding Fitting	

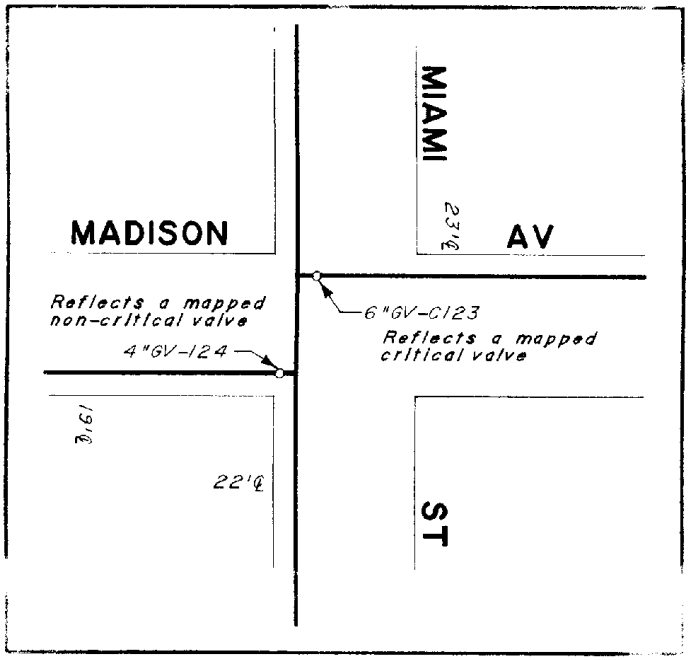
ITEM	SYMBOL
Curb valve (when used as a valve in a main) (Not to be used after April 1, 1985)	
Stopple Fitting	
Three Way Tee Shortstopp Tee	
Shortstopp Spherical Tee (Conduit Barrel Tee)	
Butterfly Valve (Not used for Regulation)	
Plastic Valve (Symbol not used after April 1, 1985)	

9. VALVE NUMBERING

Valve numbers are required for all valves in mains. For valve record information refer to GS 2400.010, GS 2400.010(KY), or GS 2400.010(PA) “Critical Valve Design Guidelines.”

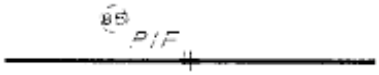
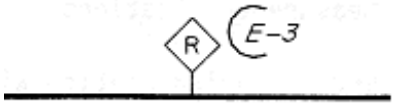
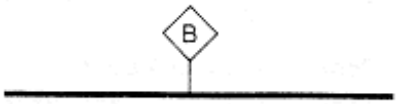
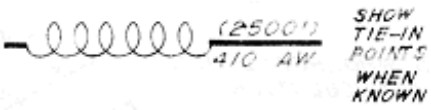
Critical valves shall be indicated by placing a "C" before the valve number as indicated on the following illustration.

To "update" maps, the "Valve Location Record," generated from WMS Report No. WLB1100, shall be submitted to the Engineering - Graphics Section with each Capital Job Order Completion Report or map revision.

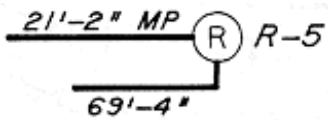


10. CORROSION CONTROL SYMBOLS

ITEM	SYMBOL
Insulated Fitting:	
Symbol used prior to April 1982	IF
Insulated coupling	IFC
Insulated coupling strapped	IFS
Insulated weld end	IFW
Live (hot) line insulator	IFL
Insulated flanges	IFF

ITEM	SYMBOL
Plastic insulated fitting (5 to 8 feet of plastic pipe)	
Insulated Gate or Valve ("IV" or side insulated)	
Interference Bond Critical	
Rectifier	
Ground Bed	GB-XXXXX
Reverse Current Switch Interference Bond	
Test Station or Test Point	
Grounding Cell	-GC
Electrolysis Wire	

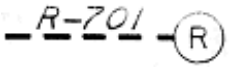
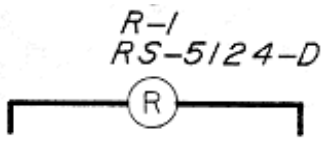
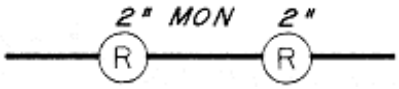
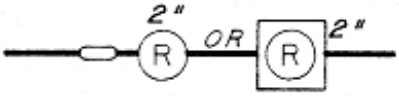
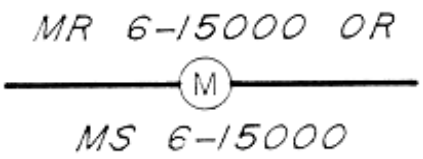
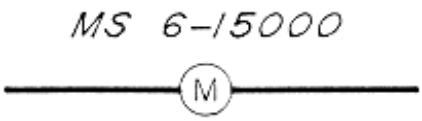
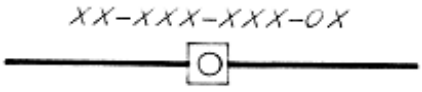
11. REGULATOR AND MEASURING STATION SYMBOLS

ITEM	SYMBOL
Regulator Station - District Regulator	

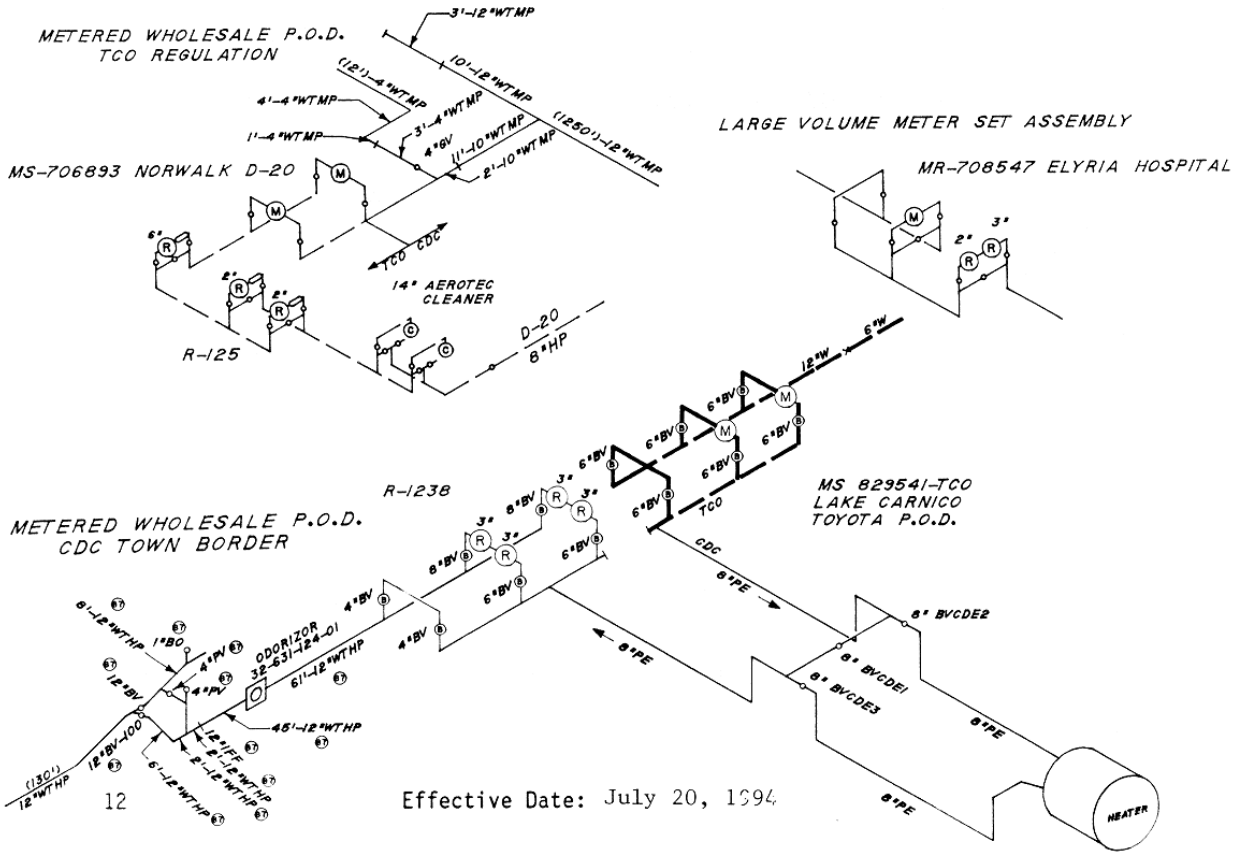
MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Map Features**	Standard Number: **GS 2610.010(CG)** P&P 550-1
Supersedes: N/A		Page 11 of 15

ITEM	SYMBOL
Regulator Station - CDC Town Border	
Regulator in detail sketch	
Monitor Regulator in detail sketch	
Regulator with heater in detail sketch	
Pipeline Heater, separate from Regulator Setting	
Cleaner (or scrubber), for Regulator & Measurement Stations	
GMB Measuring Station with number	
POD Measuring Station with number (Provide RS Number for associated regulation)	
Odorizer with number	
Customer Accounting Billing (CAB) - Meter & Regulator	

12. TYPICAL REGULATOR AND MEASUREMENT STATION DETAIL

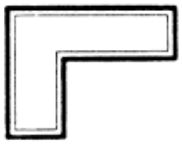
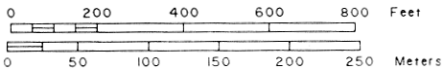


13. DEEDS, LEASES, RIGHTS-OF-WAY AND AGREEMENTS

ITEM	ABBR.
Deed (D-followed by deed numbers as issued by CDC. Not official courthouse numbers.)	D-125-50
Miscellaneous Lease or Agreement (L-followed by lease number)	L-12345
Railroad Lease (RR-followed by number)	RR-7757

ITEM	ABBR.
Rights-of-Way or Property Right Agreements (R/W-followed by number)	R/W-1235
CHC Lease or Deed, etc. Preceded by 9	9-L-3
Ground Bed Lease or R/W	GB-13456

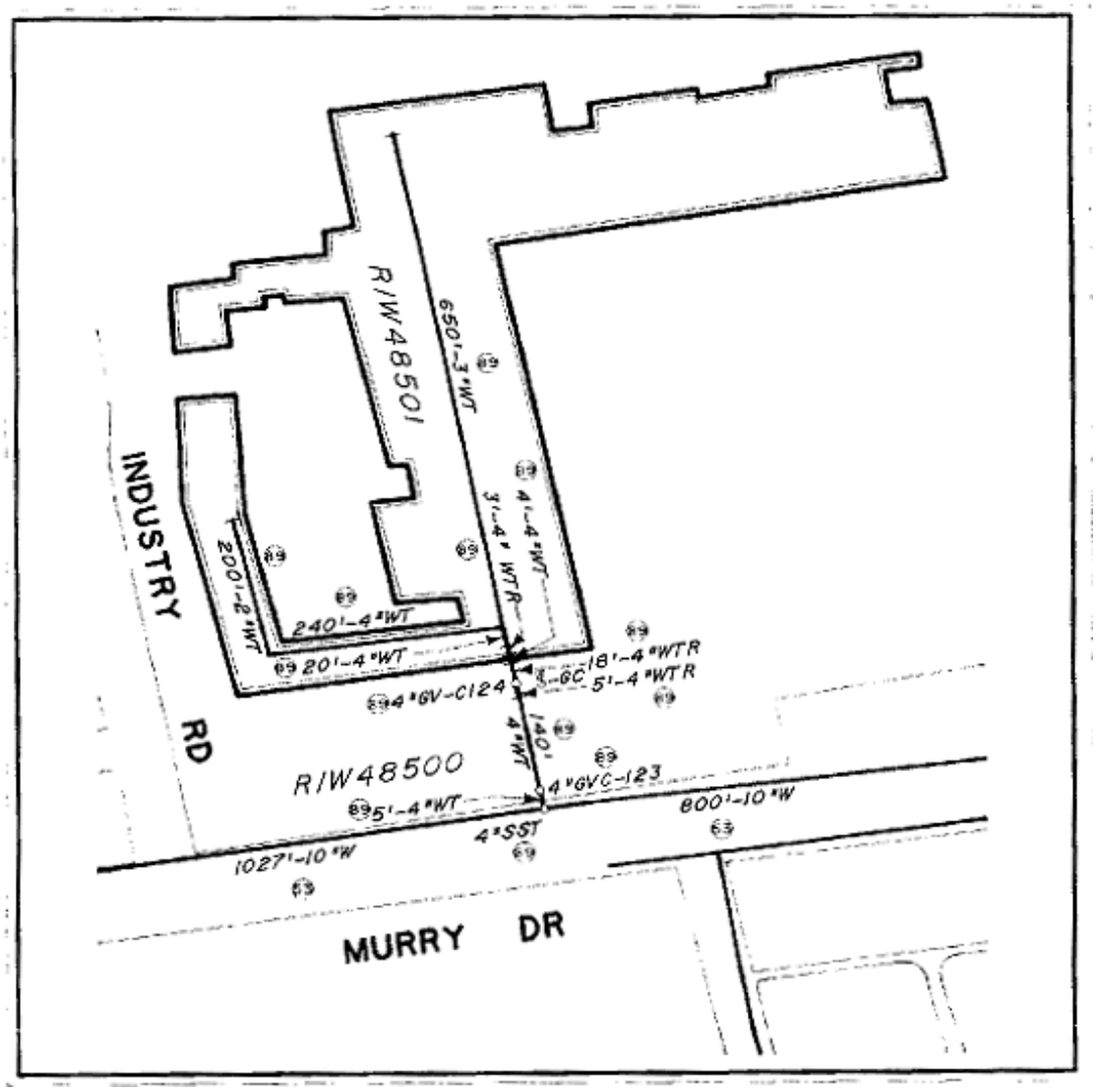
14. MISCELLANEOUS INFORMATION

ITEM	SYMBOL
Rivers or large creeks	
Building Footprint	
Streams, Creeks, Runs and Ditches	
Graphic Scale	
Property Line	P.L.
Center Line	℄

15. ROOFTOP PIPING MAPPING

Building plans showing the building outline and the location of buried, riser and roof top piping shall be provided to the Engineering - Graphics Section prior to or with the Capital

Job Order Completion Report. A typical rooftop piping installation is illustrated below:



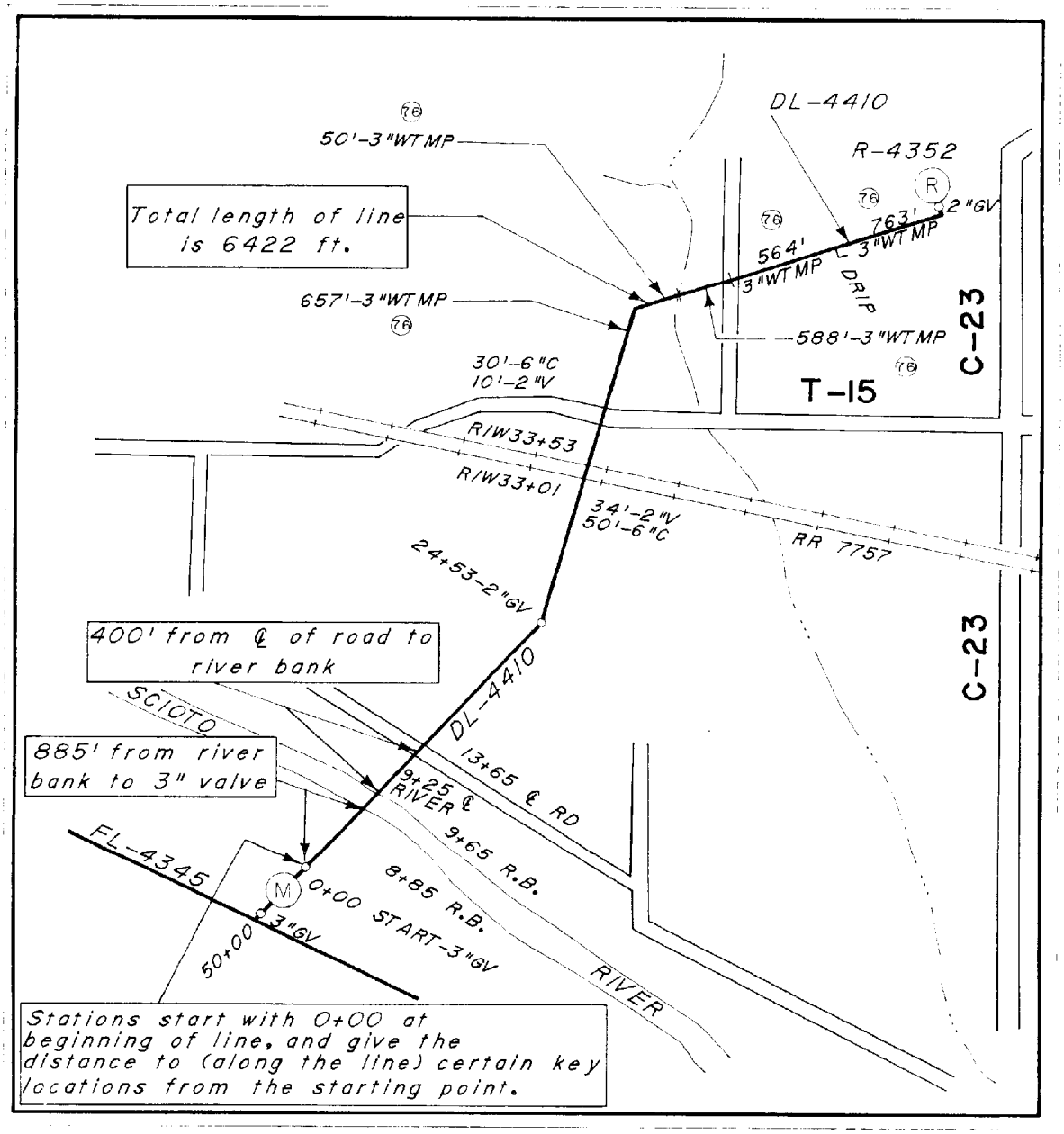
16. PIPELINE STATIONING SYSTEM

Stations will show the actual lineal distance between property lines, roads, or change of direction. The pipe amount may be less, as a portion of the distance will be occupied by valves, and various fittings not figured as line pipe.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/20/1994	**Map Features**	Standard Number: **GS 2610.010(CG)** P&P 550-1
Supersedes: N/A		Page 15 of 15



MiSource
Distribution Operations

GS Standard

Effective Date: 05/30/2011	**Mapping Reference Dimensions for Pipeline Installations**	Standard Number: **GS 2610.015**
Supersedes: N/A		Page 1 of 3

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☑ CMA	☑ CPA

1. GENERAL

Where the Company's computerized Geographic Information System (GIS) is used for mapping facilities and accessed for operational use, supplemental measurements (dimensions), such as "swing-ties", shall be recorded in the GIS for facility installations where practical (measurements should not be provided if over 100 feet). Any other offset measurements provided will also be mapped.

These measurements will be provided by Field Operations as required in Gas Standards, such as:

- GS 3010.050, "Installation of Pipe in a Ditch"
- GS 3010.060, "Installation of Plastic Pipe"
- GS 3010.080, "Underground Clearance"

The mapping of the swing-tie measurements shall adhere to the following.

1. Dimension lines will be created using only two (2) termination points.
2. The use of extension lines shall be limited whenever possible, and when needed will be placed with only two (2) termination points (start and end).
3. Dimensions will be categorized by the "DimClass" attribute, which allows for displays driven by dimension priority.
4. Standard symbology shall be used for field drawings (fixed object symbols should be consistent). See Exhibit A for the standard symbols.
5. Only those dimensions required by the referenced Gas Standards will be mapped in GIS, with the exception of valve dimensions, which shall also be mapped whenever provided. Any additional dimensions provided by the field will be retained only on the completion drawing.
6. Any dimensions taken from non-fixed structures or points will not be recorded in the GIS (e.g., trees, porches, street signs, or paint marks).
7. Dimension reference features will be placed based upon the available ortho

imagery, when visible. However, adjustment will be made as needed to maintain relative accuracy. Fixed objects not available on such imagery will be placed in the GIS based on the completion sketch.

8. Gas features will be placed relative to the locations shown on the completion sketch and then dimensions will be added. There will be no attempt made to map feature locations based upon the dimensions provided in the completion sketch. However, in some cases it may be useful to the GIS Engineering Technician to use offset dimensions, such as from road centerlines, to locate the approximate placement of gas features.

9. Local operating personnel will be responsible for ensuring that required dimensions have been provided on the completion sketch. Completion sketches received without the required dimensions, or with insufficient dimensions, will be documented as needing map corrections and communicated to the local operating personnel by the GIS group. A justification statement should accompany any sketch lacking required swing tie measurements (e.g. no fixed objects within 100 feet).

10. Dimensions will be recorded only between fixed structures and points on the pipeline facility.

11. In any case where a building is to be used as the source of dimensions, the entire building footprint shall be shown on the completion sketch, as buildings will be captured as polygons in the GIS. The building number shall be included within the polygon as provided by the Field Operations.

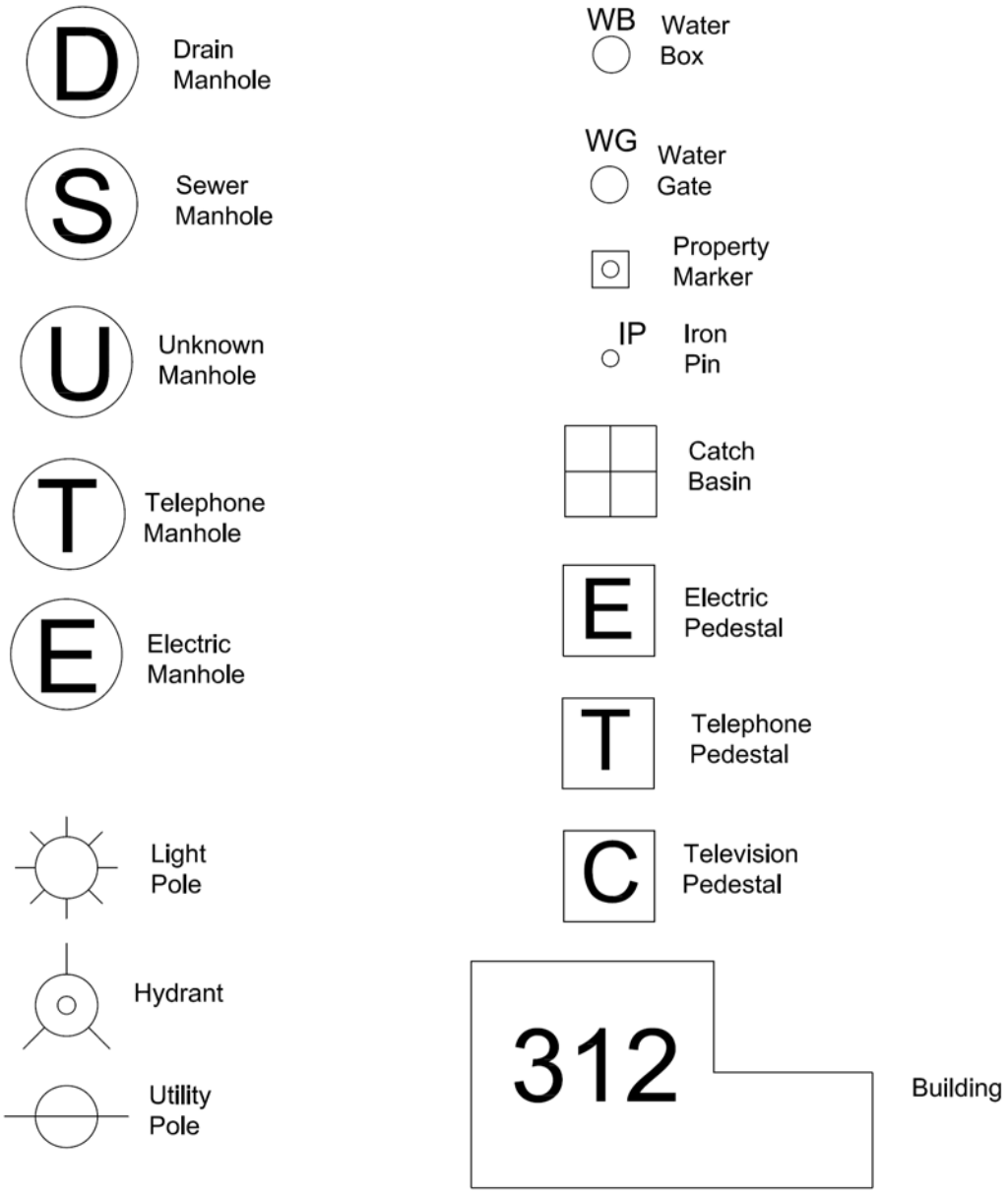
MiSource
Distribution Operations

GS Standard

Effective Date: 05/30/2011	**Mapping Reference Dimensions for Pipeline Installations**	Standard Number: **GS 2610.015**
Supersedes: N/A		Page 3 of 3

EXHIBIT A

Symbology for Fixed Objects from which Swing Tie Measurements Are Taken



Pole numbers should be noted next to the pole used for a swing tie measurement.

When using a building, measurements will be taken from the corner of a building foundation and not a moveable support (e.g., deck leg, porch support). Buildings should depict the entire, approximate structural outline. The address number of the building should be documented inside the building outline.

MiSource
Distribution Operations

Gas Standard

Effective Date: 02/16/1994	**Map Ordering**	Standard Number: **GS 2610.020(CG)** P&P 550-2
Supersedes: N/A		Page 1 of 4

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

The Engineering - Graphics Section has on file many different map types that may be beneficial for District or General Office operations. Examples are CDC Operation Maps, TCO Operation Maps, U.S.G.S. Topo Maps, various state and county maps, etc.

The General Office Reprographics Section has the capability to reproduce most maps at 100%, 65%, or 50% of their original size. They also have the capability to punch holes to fit most commercially available binders.

All requests for map reproductions should be made to the Facilities Information Graphics Supervisor via Form C 2958, "Engineering Department Facilities Information - Graphics Map Ordering Form," Exhibit A.

2. AUTOMATIC OPERATION MAP UPDATES

Each District will automatically receive copies of updated Operation Maps three times a year based on the following schedule:

Central District	January, April, July
Commonwealth Gas Services	January, April, July
Northwestern District	January, April, July
Lake Erie District	February, May, August
Lexington District	February, May, August
York District	February, May, August
Uniontown District	February, May, August

Pittsburgh District	March, June, September
Southeastern District	March, June, September
North Central District	March, June, September
Eastern District	March, June, September

These updates will consist of any Operation maps that have been modified since the District's last scheduled map order. Each District should periodically review its distribution of Operation Maps to ensure that an adequate number of updated copies are being received. Any changes to the number of updated copies required should be forwarded to the Facilities Information Graphics Supervisor.

3. SUPPLEMENTAL OPERATION MAP ORDERS

Occasionally additional copies of Operation Maps are required for things such as network analysis studies, contract line locators, market studies, etc. To order these supplemental copies Form C 2958, "Engineering Department Facilities Information Graphics - Map Ordering Form," shall be used. These map orders will normally be filled on the same three-times-a-year schedule as the automatic updates. Should the maps be needed sooner than the update schedule, a reason for the quicker turnaround shall be given on Form C 2958.

4. CORROSION/LEAKAGE MAPS ORDERS

Operation Map sets required to support the corrosion and leakage programs in all Districts will be reproduced in October, November and December each year. All requests for these map sets will be via Form C 2958 and received by the Facilities Information Graphics Supervisor prior to October 1.

5. TCO MAP ORDERS

The Engineering - Graphics Section has access to "blue-line" copies of TCO Operation Maps which can be reproduced only at reduced sizes. These maps, however, cannot be assumed to be current or accurate, therefore they must be used with caution. These maps should be requested from the Facilities Information Graphics Supervisor via Form C 2958.

MiSource
Distribution Operations

Gas Standard

Effective Date: 02/16/1994	**Map Ordering**	Standard Number: **GS 2610.020(CG)** P&P 550-2
Supersedes: N/A		Page 3 of 4

EXHIBIT A
(1 OF 2)

Instructions for completing of Form C 2958, "Engineering Department Facilities Information - Graphics Map Ordering Form."

The following items are keyed to Form C 2958, page 2 of this Exhibit.

Key	Item	Description
1	District	Self-explanatory
2	Date Requested	Self-explanatory
3	Requested By	Signature of requestor
4	Phone	Phone number of requestor
5	Approved By	Signature of District Operations Manager (or equivalent) or designee.
6	Town Name or Market Name	Indicate name of community or market on title block of map.
7	Map Number	Indicate map number on title block of map.
8	Percentage	Indicate desired size of map(s). Use a separate line for each percentage indicated.
9	Punched	Check whether map(s) are to be punched.
10	Number of Copies	Indicate number of copies for each percentage indicated.
11	Reason for Map Request	Provide a brief description of reason for map order.
12	Ship Copies To:	Provide name and mailing address of person to receive map order.

MiSource
Distribution Operations

Gas Standard

Effective Date: 02/16/1994	**Map Ordering**	Standard Number: **GS 2610.020(CG)** P&P 550-2
Supersedes: N/A		Page 4 of 4

EXHIBIT A
(2 OF 2)

COLUMBIA GAS
Distribution Companies

Engineering Department
Facilities Information – Graphics
Map Ordering Form

DISTRICT (1) _____ DATE REQUESTED (2) _____ **PAGE __ OF __**

REQUESTED BY (3) _____ PHONE (4) _____

APPROVED BY (5) _____

TOWN NAME OR MARKET NAME	MAP NUMBER	Percentage			PUNCHED		NUMBER OF COPIES
		100%	65%	50%	Y	N	
(6)	(7)	–	(8)	–	(9)	–	(10)

REASON FOR MAP REQUEST (11)

SHIP COPIES TO: (12)	FACILITIES INFORMATION GRAPHICS USE ONLY	
NAME	JOB NUMBER	
ADDRESS	DATE RECEIVED	
	DATE COMPLETED	
	COMPLETED BY	
	CHECKED BY	

FORM C 2958 CPS (8-92)

MiSource
Distribution Operations

Gas Standard

Effective Date: 12/28/1990	**Notice to Non-Employees Using CDC's Maps**	Standard Number: **GS 2610.030(CG)** P&P 550-3
Supersedes: N/A		Page 1 of 1

Companies Affected:

☐ NIPSCO	☐ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

PLANS NOTICE TO NON-EMPLOYEES USING MAPS

Whenever an operations map or portion is issued to a non-employee, regardless of purpose, that map or portion shall be stamped, preferably in red, with the following "Notice" stamp, or stamped with equivalent information.

NOTICE

THIS MAP REFLECTS ONLY THE APPROXIMATE LOCATION OF

ACTIVE MAINS AND MUST NOT BE USED TO COMMIT COLUMBIA

GAS OF ___*___ UNTIL LOCATIONS ARE VERIFIED

AND FIELD CHECKED BY THE COMPANY.

BEFORE YOU DIG CALL _____**

AT _____**

This stamp map may be ordered through Engineering Graphics.

* Commonwealth Gas Service will be substituted when appropriate.

** Name of One-Call Service and Telephone Number.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2011	**Map Revision**	Standard Number: **GS 2610.040**
Supersedes: 01/24/1994		Page 1 of 6

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

1. GENERAL

When discrepancies are discovered between field conditions and the operating map(s), a map revision shall be submitted to correct the discrepancy. Depending on how the discrepancy was discovered, the revision may be submitted either by a correction on a work management job/work order sketch or by Form GS 2610.040-1 "Map Revision/Fixed Capital Adjustments."

1.1 Construction or Retirement Work

Company Operation Maps are updated for construction and retirement work from the execution of work management Job Orders which reflects Property Units installed and/or retired. The work management Job Order sketch can also be used to make minor map corrections discovered in conjunction with the work project. (Refer to if applicable GS 2810.020(CG) "Work Order Completion Reports")

1.2 Normal O&M Work

Form GS 2610.040-1, "Map Revision/Fixed Capital Adjustments," Exhibit A, provides the means for updating or reporting the correct information in regard to:

a. discovery of incorrect or missing plant piping information, such as: location of piping facilities, pressure designation, pipe lengths, size, or material, corrosion control data, etc.

b. changes or correction to base map information such as: street, road, name changes, relative location, or vacated streets, roads, tax district boundary errors, etc.

c. other minor construction work not requiring a Job Order. Refer to if applicable GS 2810.010(CG) "Initiating an Individual Work Order."

d. showing the location of private piping systems and footprints of structures and Company owned private property piping, such as condominiums and shopping centers as they are encountered during new load additions.

Map features included on operation maps shall be in accordance with if applicable GS 2610.010(CG) "Map Features."

2. PREPARATION OF FORM GS 2610.040-1, "MAP REVISION/FIXED CAPITAL ADJUSTMENTS"

Form GS 2610.040-1 "Map Revision/Fixed Capital Adjustments," must be used for requesting corrections to Company Operations Maps. Form GS 2610.040-1"Map Revision/Fixed Capital Adjustments," shall be prepared in accordance with instructions on Exhibit A. The original shall be forwarded to Mapping. The Operating Center shall retain a copy as a control reference until a revised operation map is received.

Mapping personnel make physical inventories of Company facilities relative to boundary changes, map construction, and facility location. On those occasions the map revision will originate in the Mapping Section and require the approval of the Mapping Leader. A copy of Form GS 2610.040-1 "Map Revision/Fixed Capital Adjustments," will be forwarded to the appropriate Field Engineering Leader.

Mapping Section is responsible for determining when Fixed Capital Adjustments (FCA) are required and for completing the appropriate portion of Form GS 2610.040-1 "Map Revision/Fixed Capital Adjustments," (Exhibit A). An FCA is required when:

a. adding property units

b. removing property units

c. changing size, kind, location of facilities from one taxing district to another, or reference numbers of property units.

When completed, the original of Form GS 2610.040-1 "Map Revision/Fixed Capital Adjustments," that require FCAs shall be forwarded to Asset Accounting for verification and determination if any adjustments to the property records is required. Asset Accounting will forward the original Form GS 2610.040-1 "Map Revision/Fixed Capital Adjustments," to Vital Records Storage Section. The originals of Form GS 2610.040-1"Map Revision/Fixed Capital Adjustments," that do not require a FCA will be stamped "NO FIXED CAPITAL ADJUSTMENT REQUIRED" and forwarded by Graphics to Vital Records Storage Section.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2011	**Map Revision**	Standard Number: **GS 2610.040**
Supersedes: 01/24/1994		Page 3 of 6

EXHIBIT A
(1 OF4)

Instructions for Completion of Form GS 2610.040-1, "Map Revision/Fixed Capital Adjustments"

The following items are keyed to Form GS 2610.040-1 , "Map Revision/Fixed Capital Adjustments," pages 3 and 4, this Exhibit. Each blank must be completed.

Key	Item	Description
1	Company	Indicate appropriate operating Company for which revision is being issued.
2	Map Revision Number	Indicate three part number; Area Location number (TCC), last two digits of year and consecutive sequential number created by engineering (e.g. 001, 002, 003). Map revision number example (2421-11-001)
3	Operating Center	Indicate Operating Center Name.
4	TCC	Area number.
5	Date Issued	Indicate date revision was numbered.
6	Map Number	Indicate Operating Map Number(s) on which revision is to be made.
7	Location of Revision	Provide a brief location description.
8	Municipality or Main No.	Indicate appropriate community name or main no.
9	Tax District No.	Enter Taxing District number. The Taxing District number can be obtained from the on-line District table in DIS (65).
10	Township, or Magisterial District	Self-explanatory
11	County	Self-explanatory.
12	State	Self-explanatory.
13	Change Made on Job Order No. ---	Indicate original Work Order No., Job Order or Account No., if known.

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Distribution Operations

Gas Standard

Effective Date: 07/01/2011	**Map Revision**	Standard Number: **GS 2610.040**
Supersedes: 01/24/1994		Page 4 of 6

EXHIBIT A
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Key	Item	Description
14	Approx. Date of Physical Change	Indicate appropriate date of change when known or indicate "unknown."
15	Purpose	Indicate reason for map revision, such as: pipe size change, abandonment of dedicated street, main located on wrong side of street.
16	Prepared By	Indicate name and title of person who prepared the Map Revision.
17	Approved By	Field Engineer or designee signature.
18	Fixed Capital Adjustments Details	To be completed by Mapping personnel.
19	Comments	To be completed by Mapping personnel when appropriate.
20	FCA Prepared By	Name of individual providing FCA details.
21	FCA Reviewed By	Name of mapping representative who reviewed information. .
22	FCA Processed By	Signed off by Asset Accounting section.
23	FCA Approved By	Signed off by Asset Accounting.
24	File Data	To be completed by Mapping section.
25	Sketch (as shown - as should be shown)	Reflect how currently mapped and how information should be mapped. Note: Circle or highlight area of change for easy identification. If space is inadequate, indicate that maps or sketch, as appropriate, are attached.
26	Mapped By, Date	To be completed by Mapping section.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2011	**Map Revision**	Standard Number: **GS 2610.040**
Supersedes: 01/24/1994		Page 5 of 6

EXHIBIT A
(3 OF4)

MAP REVISION/FIXED CAPITAL ADJUSTMENT

COMPANY (1)				MAP REVISION NUMBER (2)	FILE DATA (24)
OPERATING CENTER (3)	TCC (4)	DATE ISSUED (5)		MAP NUMBER (6)	
LOCATION OF REVISION (7)					
MUNICIPALITY OR LINE NO. (8)	TAXING DISTRICT NO. (9)	TOWNSHIP, TOWN (CNY) OR MAGISTERIAL DISTRICT (10)	COUNTY (11)	STATE (12)	
CHANGE MADE ON WORK ORDER NO. OR ACCOUNT NO. (13)			APPROX. DATE OR PHYSICAL CHANGE (14)		
PURPOSE (15)					
PREPARED BY (NAME & TITLE) (16)		APPROVED BY (FIELD ENGINEER) (17)			
FIXED CAPITAL ADJUSTMENT					
DETAIL (18)					
COMMENTS (19)					
FCA PREPARED BY (20)	DATE	FCA PROCESSED BY/ASSET ACCOUNTING (22)	DATE		
FCA REVIEWED BY (21)	DATE	FCA APPROVED BY/ASSET ACCOUNTING (23)	DATE		

Form GS 2610.040.1 (7 - 2011)

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2011	**Map Revision**	Standard Number: **GS 2610.040**
Supersedes: 01/24/1994		Page 6 of 6

EXHIBIT A
(4 OF4)

SKETCH

INDICATE NORTH — SKETCH AS SHOWN ON MAP — MAP NUMBER _____

(25)

SKETCH AS SHOULD BE SHOWN ON MAP

(25)

MAPPED BY_____ (26) DATE_____

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/20/1993	**Computerizing, Map Numbers**	Standard Number: **GS 2610.060(CG)** P&P 550-6
Supersedes: N/A		Page 1 of 8

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

The combination of various companies, either through acquisition or restructuring, into what is now Columbia Gas Distribution Companies (CDC) has resulted in many different map numbering systems. In addition, Columbia Gas Transmission Corporation (TCO) map numbers are often used by CDC for reference purposes.

Because of the numerous map numbering systems, standardizing the way map numbers are entered to the computer system is essential to avoid computer search problems. This procedure establishes the nine character standardized map number data element for data entry.

2. STANDARDIZED MAP NUMBERS

2.1 Nine or Less Characters

Map numbers with nine or less characters, including punctuation, are entered left justified as illustrated below. Numbers and characters are normally entered as they appear on the maps. For example:

Map No.	Enter as
1234	|1|2|3|4| | | | | |
3759-P	|3|7|5|9|-|P| | | |
N3E1	|N|3|E|1| | | | | |
CKM-24	|C|K|M|-|2|4| | | |

There are three exceptions to the above because of character substitutions for the purpose of data entry.

EXCEPTION 1

57 • 37 — |5|7-|3|7|_|_|_|_| — (dash replaces a dot)

EXCEPTION 2

2829 60 — |2|8|2|9|-|6|0|_|_| — (dash replaces a circle)

EXCEPTION 3

U-1703
60 — |U|-|1|7|0|3|/|6|0|

1
363
192 — |1|/|3|6|3|/|1|9|2|_| — (slashes replace underlining or geographic information)

NORTH EAST

E-39
5 — |E|-|3|9|/|5|/|N|E|

2.2 More Than Nine Characters

For map numbers having more than nine characters, including punctuation, the alphabetic and numeric characters are always entered and the punctuation entered only as needed for clarity, if space is available. For example:

Map No.	Enter as
363-1-450-E-2	|3|6|3|1|4|5|0|E|2|
E-40 26-29	|E|4|0|/|2|6|-|9|

2.3 CDC/TCO UTM Maps

CDC and TCO do not display the Universal Transverse Mercator (UTM) map numbers in the same manner. Refer to Exhibit A for an explanation and illustration of the UTM map base numbers.

UTM maps numbers are entered left justified as follows:

a. Zone number -

The first digit (1 in all cases) is dropped from the zone number and the remaining digit (6, 7 or 8) becomes the first digit of the map number.

b. Easting Coordinate -

The three digit easting coordinate is entered next. For TCO UTM map numbers, the suffix character "E" is dropped.

c. Northing Coordinate -

For CDC map numbers, the three digit northing coordinate is entered.

For TCO, the first digit "4" and suffix character "N" are dropped, leaving three remaining digits to be entered.

d. Additional Suffixes -

1. To identify CDC's and TCO's 1"=800' scale maps, the suffixes "X" and "T" respectively are entered next.
2. To identify CDC's 1"=200' maps, enter the suffix letter "A thru P," as appropriate, instead of suffix "X." To identify CDC's 1"=100' maps, enter the suffix letter "A thru P," followed by the digit 1, 2, 3 or 4 as appropriate.
3. To identify TCO's 1"=400' maps designated NORTHWEST, NORTHEAST, SOUTHWEST, or SOUTHEAST enter the abbreviation NW, NE, SW or SE, as appropriate, instead of the suffix "T."

The following illustrates how the various map numbers would be entered using the above guidance:

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/20/1993	**Computerizing, Map Numbers**	Standard Number: **GS 2610.060(CG)** P&P 550-6
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Map No.	Company	Map Scale	Enter As
7668220	CDC	1”=800’	|7|6|6|8|2|2|0|_|_|
7668220A	CDC	1”=200’	|7|6|6|8|2|2|0|A|_|
7668220A2	CDC	1”=100’	|7|6|6|8|2|2|0|A|2|
4268N 17 760E	TCO	1”=800’	|7|7|6|0|2|6|8|T|_|
NORTH WEST 4228N 17 392E	TCO	1”=400’	|7|3|9|2|2|2|8|N|W|

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Gas Standard

Effective Date: 01/20/1993	**Computerizing, Map Numbers**	Standard Number: **GS 2610.060(CG)** P&P 550-6
Supersedes: N/A		Page 5 of 8

EXHIBIT A
(1 of 4)

THE UNIVERSAL TRANSVERSE MERCATOR (UTM) MAP BASE

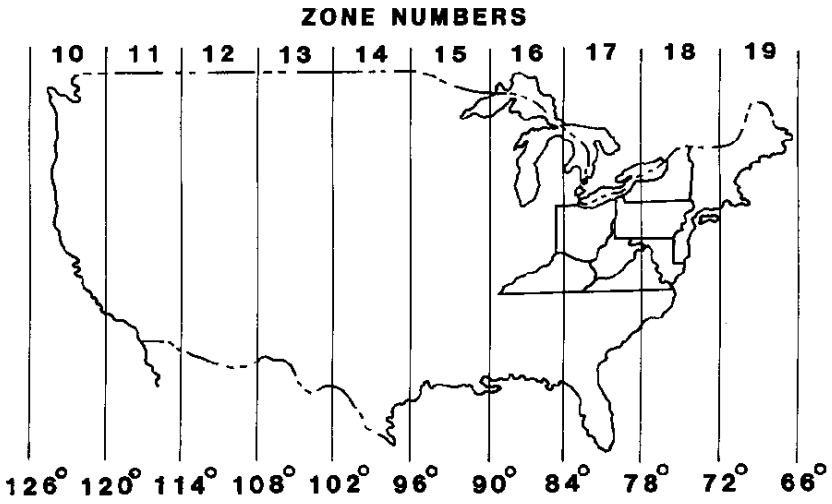
General

The Universal Transverse Mercator (UTM) System used by the United States Geological Survey (USGS) Department has been adopted by CDC and TCO for newly developed map systems. The system has been adopted (1) to produce uniform size maps, (2) to provide a uniform map base, (3) to permit conversion to an Automated Mapping (AM) System, and (4) to allow conversion to the metric scale.

A map numbering system that uses the geographic coordinates of the southwest (lower left hand) corner of each 1"=800' map as the map number has been adopted. However, the coordinates are combined in a different manner by each company to produce a map number. The coordinates are determined as follows:

Zone Number

The UTM System divides the earth into zones based on degree of longitude. The contiguous 48 states are located within Zones 10 through 19 and the CDC operating territory is located within Zones 16, 17 and 18. (See map below.)



UTM ZONES IN THE UNITED STATES

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/20/1993	**Computerizing, Map Numbers**	Standard Number: **GS 2610.060(CG)** P&P 550-6
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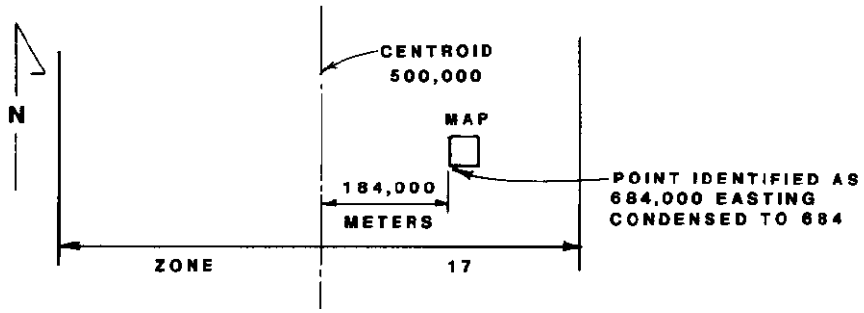
Longitude or Easting

The system of locating a point on the earth in a east-west (longitude) direction is called "easting" and is based on the zones. Each zone has a centerline drawn vertically through it. This center-line (centroid) is arbitrarily assigned the number 500,000. Each point (in 1,000 meter increments) to the east of the centroid is added to 500,000 and each point (in 1,000 meter increments) to the west of the centroid is subtracted from the 500,000, the resulting amount being the distance in meters from the centroid. The number 684,000 refers to a point 184,000 meters east of the centroid of the zone. Since the maps are numbered by the southwest corner in 1,000 meter increments from the centroid, the last three zeros are dropped by both CDC and TCO and the 684,000 becomes 684. The southwest corner of the map is exactly 184,000 meters east of the centroid (assigned number 500,000). (See following illustration.)



Latitude or Northing

The system of locating a point on the earth in a north-south (latitude) direction is called "northing" and uses the equator as a reference point. The equator is considered as "zero" and the number 4256 (see following illustration) relates to the distance north of the equator. The actual distance of the southwest corner of the map identified is four million two hundred fifty-six thousand meters (4,256,000m) north of the equator. The last three zeros are dropped by both CDC and TCO for the reason explained for "easting."

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Distribution Operations

Gas Standard

Effective Date: 01/20/1993	**Computerizing, Map Numbers**	Standard Number: **GS 2610.060(CG)** P&P 550-6
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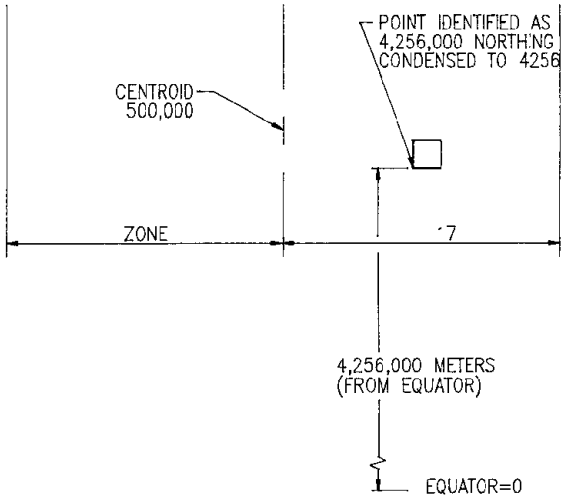
(3 of 4)

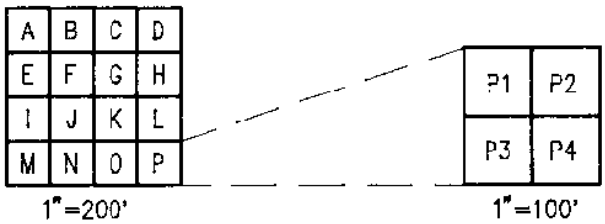


Map Scales

Both CDC and TCO operate pipelines in rural areas and normally the maps in these areas are drawn to the scale of 1"=800' and cover 16 square kilometers. TCO has some "detail" maps that are 1"=400' and cover 4 square kilometers. CDC's maps in the normal urban areas are 1"=200' and are 1 kilometer square.

Index Letters

The 1"=200' CDC maps are prepared by dividing the 1"=800' foot maps into sixteen equal sections with each section assigned a letter suffix as illustrated below. If the letter suffix were not used, the 1"=800' map would have the same map number as the 1"=200' map assigned the letter suffix "M." If the letter suffix is followed by a number, it designates the quarter section of the 1"=100' maps, as illustrated below.



MiSource
Distribution Operations

Gas Standard

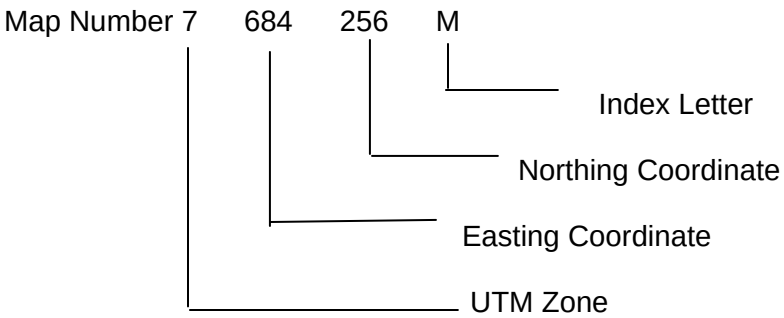
Effective Date: 01/20/1993	**Computerizing, Map Numbers**	Standard Number: **GS 2610.060(CG)** P&P 550-6
Supersedes: N/A		Page 8 of 8

EXHIBIT A
(3 of 4)

CDC Map Numbering System

Since the entire CDC operating area is located in an area between 4,000,000 and 5,000,000 meters north of the equator, CDC has elected to drop the "4" from the northing coordinate.

The following illustrates how a CDC map number is determined using the above information:



TCO Map Numbering System

TCO has elected to use a different combination of the same components, except Index Letters, to identify its map number. The following example illustrates how a TCO map number is determined.

4256 N ——— Northing Coordinate

Map Number 17 ——— UTM Zone

684 E ——— Easting Coordinate

NiSource
Distribution Operations

Gas Standard

Effective Date: 10/09/2014	**Guidelines for Avoidance of Encroachment on Company's Rights-of-Way**	Standard Number: **GS 2650.010**
Supersedes: 07/01/2013		Page 1 of 7

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE None

1. SCOPE

Establish guidelines to avoid encroachment on Company Rights-of-Way. These guidelines are to be communicated to outside parties by distribution of the pamphlet attached as Exhibit B. Deviation from these guidelines requires Engineering and/or Survey & Land (S&L) approval upon determination that the facts in each case warrant exception.

2. EASEMENT WIDTHS

2.1 Minimum Widths for Existing Land Documents

If the land document does not state a specific width, the following minimum widths should apply:

a. Pipelines 6 inches or less in diameter and less than or equal to 60 psi, the easement width should be twenty (20) feet wide.

b. For pipelines greater than 6 inches in diameter and/or pressure greater than 60 psi, the easement should be fifty (50) feet wide.

c. For multiple pipelines, contact Engineering and/or Survey & Land.

2.2 Minimum Widths for New Land Rights

The minimum widths for land rights acquired for new pipelines should be the same as those in Section 2.1.

3. ENCROACHMENT ON COMPANY RIGHTS-OF-WAY

Encroachments within right of way limits include, but are not limited to:

a. Structures, (i.e., pools, decks, out-buildings, man-made bodies of water)

b. Dwellings

c. Garages

d. Operation of heavy equipment

e. Grading operations, (i.e., cut or fill)

f. Planting and/or removal of trees and shrubs

g. Septic tanks, lines or leach beds

h. Restriction to access of Company's right of way, (i.e., fences, concrete, walls, brush piles, physical threats, etc.)

i. Unapproved utility installations

Any planned encroachment or encroachment that is in the process of construction or placement upon Company Right-of-Way that is discovered by local field personnel should, as soon as possible, be reported to the local Leader or Manager. The reporting party should attempt to educate and reason with the encroaching party to have the encroachment(s) removed. The Leader or Manager shall initiate a request to investigate the encroachment. Request to investigate the encroachment and take appropriate action shall be directed to Survey & Land. Refer to Exhibit A for detailed Encroachment Investigation/Resolution Process.

Any encroachment to a Company pipeline that poses an immediate threat to life or property shall be reported immediately upon discovery. Reports of encroachment should include a detailed summary (preferably with photographic documentation).

4. CABLES, PIPELINES AND OTHER FACILITIES CROSSING COMPANY PIPELINES

When an outside utility or third party request permission or requirements for crossing of Company facilities, several factors should be taken into consideration. The following list includes, but is not limited to, items to be considered:

a. Line type, size and pressure of gas pipeline

b. Leak history

c. Betterment or replacement plans

d. Site conditions

e. Number of proposed crossings

f. Potential of heavy equipment crossing impacts

g. Proposed installation of aboveground facilities

h. Cathodic protection requirements

i. Depth of Company facilities

j. Depth of proposed utility installation

In addition, the following are guidelines for the installation of the other utilities:

a. Utility and fiber optic lines should cross Company pipelines at/or as near practical

to 90 degrees.

b. The utility or fiber optic line should maintain a minimum clearance as required by each distribution company's policies.

c. Electric and fiber optic lines should cross below Company pipelines and be encased for the complete width of the Rights-of-Way.

d. All underground utilities crossing Company facilities should be installed with warning tape, marker posts, or both.

Company personnel should be proactive in providing these guidelines to other parties planning to cross our facilities where we maintain private Right-of-Ways.

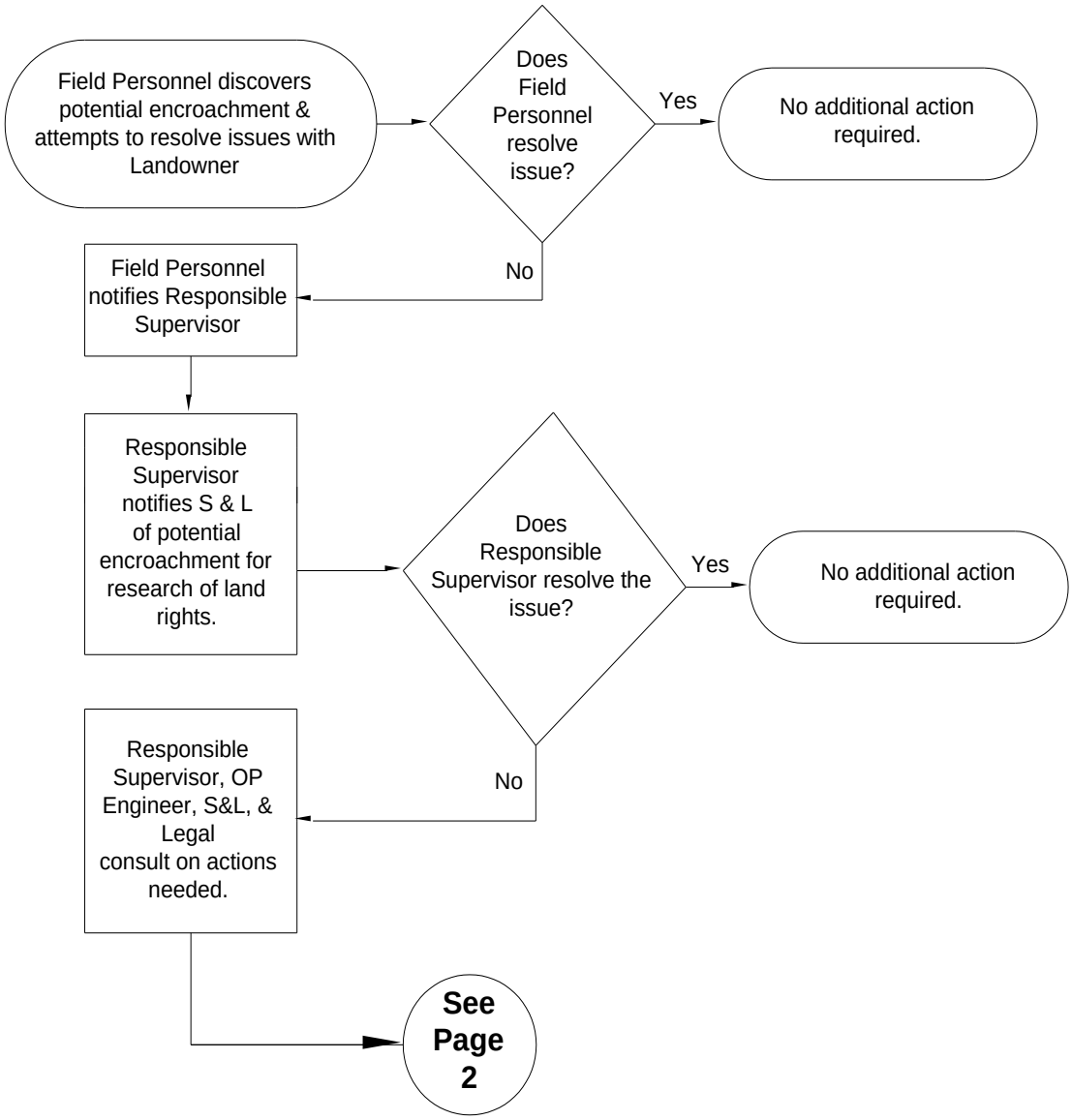
MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2013	**Guidelines for Avoidance of Encroachment on Company's Rights-of-Way**	Standard Number: **GS 2650.010**
Supersedes: N/A		Page 4 of 7

EXHIBIT A
(1 OF 2)

Encroachment Procedure Flow Chart



MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2013	**Guidelines for Avoidance of Encroachment on Company's Rights-of-Way**	Standard Number: **GS 2650.010**
Supersedes: N/A		Page 5 of 7

EXHIBIT A
(2 OF 2)

Encroachment Procedure Flow Chart

Continued

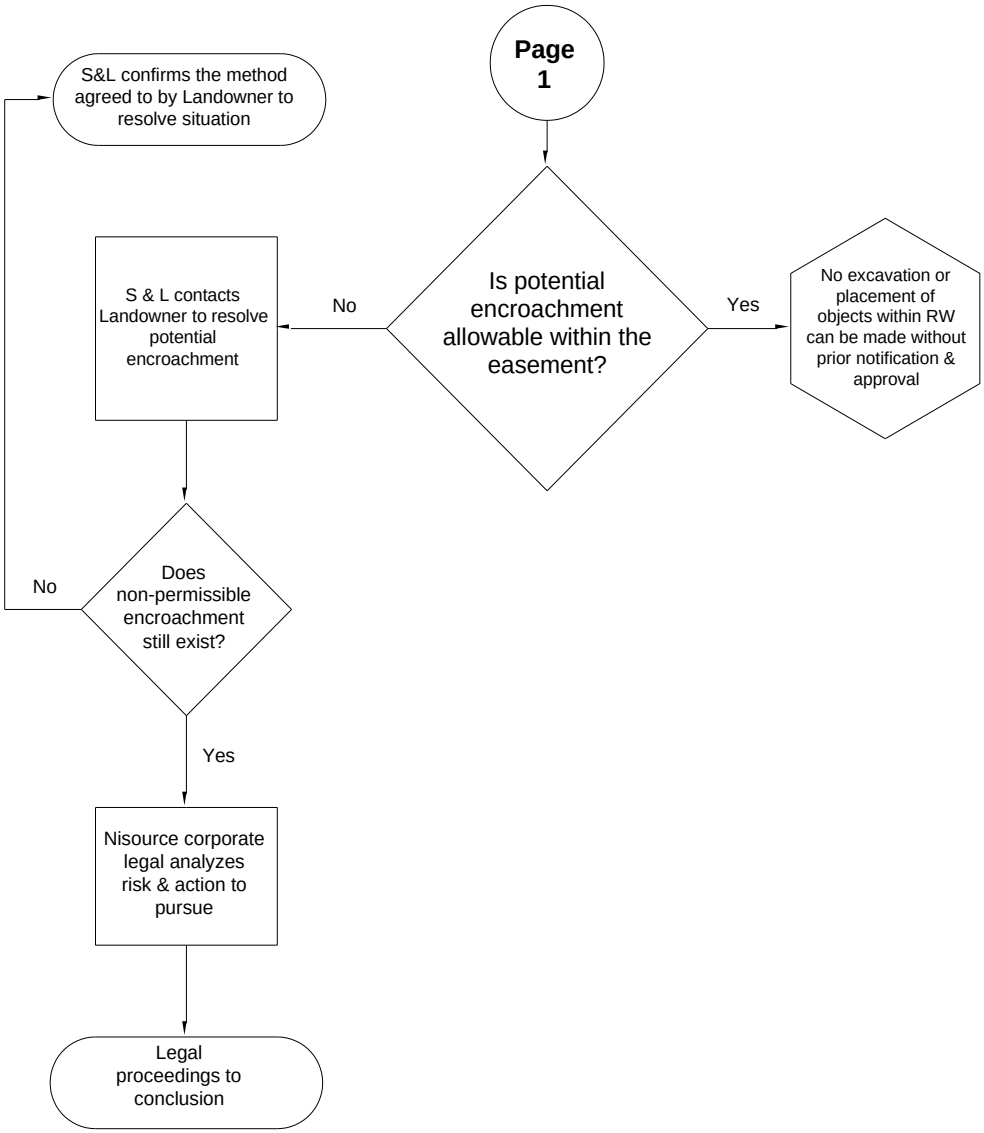


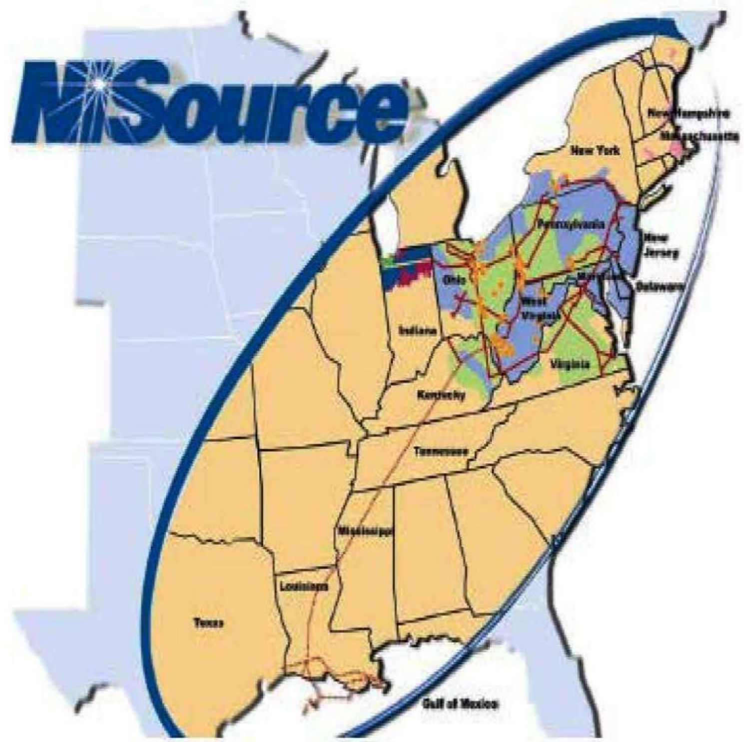
EXHIBIT B
(1 of 2)

NiSource

For more details, please call the following numbers and ask for the Survey & Land representative in your state.

Columbia Gas of Kentucky (A NiSource Company)	1-800-432-9345	Columbia Gas of Pennsylvania (A NiSource Company)	1-888-460-4332
Columbia Gas of Maryland (A NiSource Company)	1-888-460-4332	Columbia Gas of Virginia (A NiSource Company)	1-800-543-8911
Columbia Gas of Ohio (A NiSource Company)	1-800-344-4077	Columbia Gas of Massachusetts (A NiSource Company)	1-800-677-5052

OHIO Ohio Utilities Protection Services (OUPS) 1-800-362-2764 or 811 http://www.oups.org/	Ohio Utilities Protection Service Call 811 before you dig
KENTUCKY Kentucky 811 1-800-752-6007 or 811 http://kentucky811.org/	Kentucky811 Know what's below. Call before you dig.
MARYLAND Miss Utility of Maryland 1-800-282-8555 or 811 http://www.missutility.net/maryland/	811 Know what's below. Call before you dig.
MASSACHUSETTS DIGSAFE 1-888-DIG-SAFE (1-888-344-7233) or 811 http://www.digsafe.com/	811 DigSafe MA-ME-NH-RI-VT
PENNSYLVANIA Pennsylvania One Call System, Inc. 1-800-242-1776 or 811 http://www.pa1call.org/PA811/Public/	Pennsylvania One Call System, Inc. 1-800-242-1776 Stop-Call Before You Dig!
VIRGINIA Miss Utility of Virginia 1-800-552-7001 or 811 http://va811.com/	va811.com Dig With Care



GUIDELINES FOR AVOIDANCE OF ENCROACHMENT ON COMPANY RIGHTS-OF-WAY

Columbia Gas of Kentucky
Columbia Gas of Maryland
Columbia Gas of Ohio
Columbia Gas of Pennsylvania
Columbia Gas of Virginia
Columbia Gas of Massachusetts

Form GS 2650.010-1 (10/2014)

Encroachment on Company Rights-of-Way

Encroachments within pipeline right-of-way limits include, but are not limited to:

- Structures, e.g., pools, decks, out-buildings, man-made bodies of water
- Dwellings
- Garages
- Operation of heavy equipment
- Grading operations (i.e., cut or fill)
- Planting and/or removal of trees and shrubs
- Septic tanks, lines or leach beds
- Restriction to access of Company's right-of-way (e.g., fences, concrete, manholes, walls, brush piles, physical threats, etc.)
- Unapproved utility installments

Any planned encroachment or encroachment that is in the process of construction or placement upon Company pipeline Right-of-Way will be investigated by Company representatives. Appropriate action will be taken to ensure safe operation of Company's facilities.

Cables, Pipelines and Other Facilities Crossing Company Pipelines

All utilities or third parties must notify NiSource prior to construction. When crossing Company facilities, the following factors are to be taken into consideration

- Other Utilities and fiber optic lines must cross Company pipelines at/or as near practical to 90 degrees.
- The utility or fiber optic line must maintain a minimum clearance as required by the Company.
- Electric and fiber optic lines must cross below Company pipelines and be encased for the complete width of the Company Right of Way.
- All utilities crossing Company facilities must be installed with warning tape, marker posts, or both.
- Should contact be made with a natural gas pipeline resulting in a release of product turn off any motorized equipment and have all persons moved to a safe location.
- From a safe location immediately contact 911 and Columbia Gas.

MiSource
Distribution Operations

Gas Standard

Effective Date: 09/13/2005	**Abandonment of Public Rights-of-Way**	Standard Number: **GS 2650.020(CG)** P&P 540-6
Supersedes: N/A		Page 1 of 4

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

Governmental agencies, such as states, counties, townships, municipalities and boroughs, often desire to abandon or vacate public rights-of-way, such as highways, roads, streets, alleys or dedicated utility easements. Normally, abandonment notices are given to the Company by the appropriate governmental agency or appear in local newspapers, usually for a minimum of two weeks, under "Public Notices."

When local Operations becomes aware of a proposed public abandonment or vacating, it shall investigate and determine whether Company facilities occupy the land. Whether the Company occupies the land or not, Company rights pertaining to existing or potential facilities use shall be explored. Additionally, Survey & Land shall be consulted before a course of action is taken.

The Company's rights may be protected by state codes or by prescriptive rights.

2. PROCESSING ABANDONMENT NOTICES

2.1 Notices

Notices concerning abandonments by governmental agencies may be verbal, in writing, or as a "Public Notice" in a newspaper.

Notices may be received by local Operations. All notices shall be sent to Survey & Land together with information about the facilities that are affected.

2.2 Investigation

Survey & Land shall notify Engineering who will conduct an investigation to determine if the Company has facilities or is planning facilities for the public right-of-way.

2.3 Notification to Release Company Rights

If the public right-of-way to be abandoned has no Company facilities and if none are planned for the location, Engineering will prepare a letter of release to the requesting

governmental agency. The letter will state that the Company has no objection to the proposed abandonment. A sample of such a letter is shown in Exhibit A.

2.4 Notification to Retain Company Rights

If the public right-of-way to be abandoned contains Company facilities or if the Company has future use for this location, Engineering will prepare a letter to the governmental agency. The letter will request the governmental agency to protect the Company's rights through the granting of a permanent easement in the ordinance or other abandonment document. This permanent easement shall provide for the operation, maintenance, replacement and removal of the Company's existing or proposed facilities as well as access for those purposes. A sample of such a letter is shown in Exhibit B.

A copy of the letter, the ordinance, and corresponding ordinance reference number with the location of the proposed abandonment cross referenced to an Operations Map, shall be sent to Survey & Land.

2.5 Notification of Rights Secured

Upon securing the necessary rights for the Company's existing or planned facilities in the public right-of-way to be abandoned or vacated, Survey & Land shall notify Engineering and local Operations.

MiSource
Distribution Operations

Gas Standard

Effective Date: 09/13/2005	**Abandonment of Public Rights-of-Way**	Standard Number: **GS 2650.020(CG)** P&P 540-6
Supersedes: N/A		Page 3 of 4

EXHIBIT A

[COMPANY LETTERHEAD]

Date

City Engineer
City Hall
City, State Zip

Dear City Engineer:

Columbia Gas of _____, Inc., with principal offices at _____, has been requested to investigate its facilities in the proposed vacation of the following area:

TO VACATE DAKOTA AVENUE, FROM THE NORTH LINE OF MOUND STREET TO THE SOUTH LINE OF THE FIRST ALLEY NORTH OF MOUND STREET.

Columbia's investigation reveals that it does not have any facilities within the proposed vacation; therefore, Columbia has no objection to the proposed vacation.

Yours very truly,

[Appropriate Operations Representative]

cc: Survey & Land

MiSource
Distribution Operations

Gas Standard

Effective Date: 09/13/2005	**Abandonment of Public Rights-of-Way**	Standard Number: **GS 2650.020(CG)** P&P 540-6
Supersedes: N/A		Page 4 of 4

EXHIBIT B

[COMPANY LETTERHEAD]

Date

City Engineer
City Hall
City, State Zip

Dear City Engineer:

Columbia Gas of _____, Inc., with principal offices at _____, has been requested to investigate its facilities in the proposed vacation of the following area:

MAJOR ALLEY
EXTENDING FROM EAST LINE OF SIXTH STREET
TO WEST LINE OF THE ALLEY EAST OF SIXTH STREET

Columbia's investigation has revealed that it has facilities within the area proposed to be vacated; Columbia objects to the proposed vacating unless there is a reservation protecting its facilities or a right-of-way agreement granted to protect said facilities. The reservation should provide for the operation, maintenance, replacement and removal of the facilities.

If the subject area is vacated, would you please notify me and, if possible, furnish a copy of the vacating ordinance.

Yours very truly,

[Appropriate Operations Representative]

cc: Survey & Land

MiSource
Distribution Operations

Gas Standard

Effective Date: 09/13/2005	**Acquiring/Disposing of Land and Land Rights**	Standard Number: **GS 2650.030(CG)** P&P 540-7
Supersedes: N/A		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. PLANS DEFINITIONS

Land is real estate (excluding buildings and structures) owned in fee and conveyed by deed.

Land Rights are those rights, privileges and interest in land owned by others, acquired for a period of one or more years. Typical land rights are easements, rights-of-way, leases and licenses.

Easement is a right to use land of another for a specific purpose. Generally, consideration is a one-time payment.

Right-of-way is a conditional right to use land of another with the owner of the land retaining most rights and benefits of ownership. Consideration is a one-time payment.

Lease is a right to use land of another for a specific purpose and a certain period of time. Generally, consideration is received periodically.

License is a permit, granted generally for a consideration, with specific respect to land of another.

Temporary Land Right is a land right normally held for a period of less than one year.

2. ACQUISITION

A Job Order shall be created by Operations when land or land rights are required. Operations then shall forward to Survey & Land a Land Services Request, which becomes the authority for Survey & Land to acquire the land or land rights, and will reflect the Job Order number.

2.1 Incurred Cost

Costs incurred in acquiring land or land rights are charged to the Job Order using the appropriate Cost Element Code. Costs incurred in securing temporary land rights for use in connection with a construction project shall be charged to the Job Order, whereas those costs not associated with a construction project shall be expensed.

2.2 Completion Reports

Survey & Land shall notify Operations that the land acquisition or disposal of land or land rights is completed. A copy of this notification shall be filed with the completion report.

2.3 Services Request Cancellation

When a Job Order involving the acquisition of land or land rights is to be cancelled, Survey & Land shall be notified at the earliest possible date.

2.4 Future Use Land or Land Rights

If land or land rights acquired will not be used in a reasonable period of time, costs shall be transferred to: General Ledger 105, "Gas Plant Held for Future Use," or General Ledger 121-4, "Non-utility Properties - Land," as appropriate.

3. DISPOSAL OF LAND OR LAND RIGHTS

When there is no future planned use for land or land rights, Operations shall issue a retirement Job Order.

3.1 Sale of Land

When land is to be sold, Operations shall furnish Survey & Land with an approved retirement Job Order and all pertinent data regarding the land.

Survey & Land will then investigate the feasibility of the sale, obtain the necessary Company approvals, and attempt to locate a purchaser. If the feasibility of the sale has been determined to be in excess of $100,000, the retirement Job Order and all pertinent data regarding the land will be forwarded to Nisource Corporate Real Estate to complete the sale transaction.

4. ENVIRONMENTAL COMPLIANCE

The acquisition and/or disposal of any land or land rights shall be coordinated by Survey & Land and reviewed by the Environmental and Legal Departments for compliance with all corporate policies.

MiSource
Distribution Operations

Gas Standard

Effective Date: 09/13/2005	**Bill of Sale / Assignment of Facilities From or to Others**	Standard Number: **GS 2650.040(CG)** P&P 540-9
Supersedes: N/A		Page 1 of 1

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

The Company occasionally desires or is requested to acquire or sell pipelines, regulation and/or measuring stations, radio installations, service centers, etc., from or to individuals or corporations. In such cases, Survey & Land will act as agent in the securing of the necessary agreements for the purchase or sale of the facilities and associated land rights.

Acquisition or sale of property between affiliated companies is not within the scope of this procedure. The Finance department will provide the actual booked value of existing facilities if necessary.

2. REQUEST FOR LAND SERVICES

For all purchases and sales of pipelines and other facilities, there should be an approved job order which requests Survey & Land to investigate or provide services in the transaction.

3. SURVEY& LAND

Upon receipt of a Request for Land Services, Survey & Land will, as appropriate:

a. Initiate any environmental and legal reviews required for compliance with Company and corporate policies.

b. Secure the necessary Company approvals pursuant to the corporate Accountability Policy and notify the requesting party.

c. Record the fully executed agreement in the appropriate county.

d. Notify all affected stakeholders that an agreement(s) has been secured and furnish them with a copy of the agreement.

e. Retain all agreements and documents and make changes to any other agreements or records which are affected by this transaction.

NiSource
Distribution Operations

Gas Standard

Effective Date: 09/13/2005	**Leases, Licenses, and Permits**	Standard Number: **GS 2650.060(CG)** P&P 540-11
Supersedes: N/A		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. PLANS DEFINITIONS

Agreements covered in this procedure are for any of the following: regulator site, office, warehouse, parking lot, railroad crossing, longitudinal occupancy, bridge occupancy, street crossing, highway occupancy (if payment is required), communication tower site, gas storage, sublease, etc.

A lease is an agreement between a NiSource company and an owner of real property that gives the company the right to use and occupy that property in exchange for a consideration. In most cases, the consideration consists of periodic payments to the property owner.

A license or permit allows a NiSource company to perform designated acts upon, or make specific use of, real property owned by the grantor of the license or permit. Generally, a license or permit requires the payment of a consideration to the grantor.

2. AGREEMENT PROCESSING

Upon acquisition of a new agreement or when notified of an ownership change, Survey & Land shall notify the appropriate departments/personnel as follows:

a. Finance – the federal tax ID number or social security number is required on the notification.

b. For offices or building sites, the Operations Center Manager and the Tax, Insurance, and Real Estate departments.

3. SURRENDER OF AGREEMENTS

Upon receiving an approved Job Order for surrendering a lease, license or permit, Survey & Land shall:

a. Ensure compliance with corporate legal and environmental policies for disposal of land rights, and

b. Prepare a notice and forward to the Finance, Insurance, Tax, and other

departments as applicable for notification that the agreement has been surrendered.

4. EXPIRING LEASES

The Finance department shall prepare and furnish Survey & Land with a list of leases due to expire at least one year prior to their expiration dates.

Survey & Land shall:

a. Verify the list with original documents.

b. Notify Operations of those leases due to expire with a request to notify Survey & Land as to which lease(s) shall be renewed.

4.1 Leases with Renewal Option

If advised by Operations of the desire to renew a lease, Survey & Land shall notify the landowner of the Company's intent by letter. The notification letter shall be executed in compliance with the corporate Accountability Policy.

4.2 Leases with a Termination Date

If advised by Operations that a lease needs to be renewed or extended, Survey & Land shall contact the landowner and negotiate a new agreement.

Note: The new agreement shall retain the original lease number.

4.3 Leases Permitted to Expire

If advised by Operations that a lease will be permitted to expire, action will follow that outlined in Section 3.

MiSource
Distribution Operations

Gas Standard

Effective Date: 06/18/1982	**Quality Control - Meter**	Standard Number: **GS 2730.010(CG)** P&P 556-2
Supersedes: N/A		Page 1 of 6

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE Columbia Gas System Index of Material Standards, Number 8

1. GENERAL

Quality control tests shall be made in accordance with this procedure as soon as possible after receipt of meters. Meters in a shipment shall be held until the quality control tests are completed and accepted.

2. RESPONSIBILITY

The Meter Shop Superintendent/Supervisor shall be responsible for the quality control testing of all new meters received in the meter shop.

3. SAMPLING PLAN*

Meters received shall be quality control tested using the following sampling plan.

Lot Size	Allowable Sample Size	Rejects
2 - 8	2	1
9 - 15	3	1
16 - 25	5	1
26 - 50	8	1
51 - 90	13	1
91 - 150	20	2
151 - 280	32	3
281 - 500	50	4
501 - 1200	80	6
1201 - 3200	125	8
3201 - 10,000	200	11

* Mil-STD-105D, A.Q.L-2.5, Inspection Level II, Single Sampling Plan, Normal Inspection, Random Selection.

The lot shall consist of all of the same type and size meters in a shipment received from the manufacturer or grouped for shipping by the manufacturer.

4. TEST CONDITIONS

New meters shall be tested in the meter shop using the following conditions:

4.1 Test Medium

Air

4.2 Pressure Control

4.2.1 Bell Prover

a. Bell provers shall be weighted to give 1.5 to 2.0" W.C. pressure at the prover outlet valve.

b. The piping connecting the bell prover to the meter shall be sized so that at any flow rate the differential pressure between the prover and meter does not exceed 0.4" W.C.

4.2.2 Transfer Prover

a. Transfer provers shall use vacuum type testing.

b. The pressure difference between the meter and the transfer prover shall be determined.

4.3 Temperature

4.3.1 Bell Prover

a. Maximum temperature difference of all equipment including prover oil, prover air and the air through the meter to be tested shall not exceed 3.0°F.

b. Changes in the temperature of the prover air or ambient air shall not exceed 1°F in one hour.

4.3.2 Transfer Prover

The difference in temperature between the meter, and the transfer prover shall be determined.

4.4 Prover Leak Test

The meter proving system, including the meter, shall be tested to assure that it is leak free before starting the test to determine meter accuracy.

4.5 Volumetric Accuracy

4.5.1 Bell Prover

Bell provers shall be verified or calibrated and certified by Commission Representatives.

4.5.2 Transfer Prover

Transfer provers shall be verified or calibrated annually using a reference standard traceable to the National Bureau of Standards.

4.5.3 Accuracy Requirements

The reading and recording of the test results for the bell and transfer provers shall be accurate to 0.1%.

4.5.4 Bell Prover Test Methods

a. The meter test hand shall be used for proving meters. The test hand on a vertical index shall be read on the upstroke.

b. The test hand shall be started and stopped in exactly the same position.

c. The minimum volume passed during a test shall be the volume indicated by a complete cycle of the test hand, but not less than two cubic feet except where a pulse type prover meter is used.

4.5.5 Transfer Prover Test Methods

a. The meter index shall be removed and the transfer prover automatic gate control installed. The test volume is a function of the volume for one revolution of the meter output shaft multiplied by the selected number of out-put shaft revolutions. The manufacturer's instructions shall be followed to select the correct test volume.

b. The accuracy of the meter under test shall be corrected for the volumetric error of the transfer prover at the selected flow rate.

4.6 Flow Rates

4.6.1 Diaphragm Meters - 500 CFH Capacity and Under

Two flow rate tests are required for diaphragm meters having a capacity of 500 CFH and under. These tests are:

a. Capacity Rate Test

Capacity rate test shall be made at an air flow rate of approximately 100% of the badged capacity of the meter at 0.5" W.C. differential pressure. Example: use an air flow rate of 175 CFH when testing a meter with a badged capacity of 175 CFH.

b. Check Rate Test

Check rate test shall be made at an air flow rate of approximately 20% of the badged capacity of the meter at 0.5" W.C. differential pressure. Example: use an air flow rate of 35 CFH when testing a meter with a badged capacity of 175 CFH.

4.6.2 Diaphragm Meters - Over 500 CFH Capacity

Flow rate tests for diaphragm meters over 500 cubic feet per hour capacity shall be made at approximately 10, 50 and 100% of the badged capacity of the meter at 2" W.C. differential pressure. A reduced air flow rate shall be used to compensate for the specific gravity of air compared to gas.

4.6.3 Rotary Meters

Flow rate tests for rotary meters shall be made at approximately 10, 50 and 100% of the badged capacity of the meter. Where proving equipment does not permit testing of the meter to the badged capacity, tests shall be made to the capacity of the prover but not less than the point where the meter accuracy curve becomes flat as compared to the manufacturers accuracy curve.

4.6.4 Turbine Meters

Flow rate tests for turbine meters shall be made at approximately 10, 50 and 100% of the badged capacity of the meter. Where proving equipment does not permit testing of the meter to the badged capacity, tests shall be made to the capacity of the prover but not less than the point where the accuracy curve becomes flat or maintains a slight positive slope as compared to the manufacturer’s accuracy curve.

5. TEST SPECIFICATIONS

Meter test results shall be expressed in percent accuracy.

5.1 Diaphragm Meters - 500 CFH Capacity and Under

Diaphragm meters of 500 CFH capacity and under shall meet the following specifications when tested using a bell prover.

a. Meters shall be accurate to a tolerance between 99.3 and 100.5% at check and capacity flow rates at 0.5" W.C. differential pressure. The difference in accuracy between the capacity and check flow rate tests shall not exceed 1%.

b. The pressure drop between the meter inlet and outlet shall not exceed 0.30 inch W.C. and the pressure fluctuation shall not exceed 0.20 inch W.C. during the check flow rate test.

c. Approximately 10% of the meters sample tested shall be given a pressure test of 5 psig while submerged in water to determine that they are free from external leakage. Prior to performing the external leakage test, the meter index shall be removed and examined to assure proper alignment and meshing of the index gears.

5.2 Diaphragm Meters - Over 500 CFH Capacity

Diaphragm meters over 500 CFH capacity shall be accurate to a tolerance between 99.3 and 100.5% at flow rates of approximately 10, 50 and 100% of the meter badged capacity at 2" W.C. differential pressure. The difference in accuracy between any test results shall not exceed 1.0%.

5.3 Rotary Meters

Rotary meters shall be accurate to a tolerance between 99.0 and 100.5% at a flow rate of approximately 10% of the meter badged capacity and between 99.5 and 100.5% at flow rates of approximately 50 and 100% of the meter badged capacity.

5.4 Turbine Meters

Turbine meters shall be accurate to a tolerance between 99.4% to 100.6% at flow rates of approximately 10, 50 and 100% of the meter badged capacity.

6. VISUAL INSPECTION

A visual inspection shall be made to determine that:

a. index is sealed on meters having a 500 CFH capacity and under.
b. wire and seal is supplied with meters over 500 CFH capacity.
c. there are no loose or missing screws.
d. paint is not defective or per specification.
e. threads are not defective on inlet and outlet connections.
f. thread protector caps are installed on inlet and outlet meter connections.
g. index box or window is not cracked or loose.

7. REJECTIONS

A meter shall be rejected for any one of the following conditions:

a. accuracy and/or pressure differential exceeds the tolerances as specified in Section 5
b. external leakage
c. malfunctioning index
d. noisy
e. visual inspection reveals defects as specified in Section 6.

If the number of rejects exceeds the allowable number as specified in the Sampling Plan, Section 3, the entire shipment shall be rejected and the Supply and Utilization - Service - Measurement and Regulation Manager shall be notified. The entire shipment shall be held at the meter shop pending further instructions.

Supply and Utilization - Service in conjunction with Administration - General Services - Purchasing in lieu of rejecting the entire shipment and returning all meters to the manufacturer may elect to test 100% of the shipment at manufacturer's expense, then the decision will be made to:

a. purchase only those meters meeting quality control standards.
b. calibrate and/or repair at manufacturer's expense depending on type defects found, and purchase meters.
c. return entire shipment, depending on type defects found.

The option shall only be decided upon after prior consultation with manufacturer regarding expenses to be incurred for testing, calibration, and/or repair.

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/20/1992	**Quality Control - Monitoring**	Standard Number: **GS 2730.020(CG)** P&P 556-5
Supersedes: N/A		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE CDC - Index of Material Standards

1. PLANS GENERAL POLICY STATEMENT

Columbia Gas Distribution Companies (CDC) requires quality control tests by the manufacturer. This assures that products manufactured meet the requirements in CDC's Index of Material Standards.

2. RESPONSIBILITY

General Services - Purchasing is responsible for obtaining quality control plans and reports from the manufacturer, when applicable.

Material Coordinating Committee (MCC) is responsible for approving a manufacturer's quality control plan.

Engineering - Material Standards and Testing Section (MSTS) is responsible for monitoring reports from the manufacturer and inspecting the manufacturer's facilities for compliance.

3. TESTING

MCC will assure that the manufacturer's quality control plan includes sufficient testing to verify that its product meets the design, performance and quality assurance provisions of the appropriate Index of Material Standards. The tests shall be recorded as part of the quality control program.

4. CERTIFICATION

When deemed necessary by MCC, the manufacturer shall be requested to furnish a written certification stating that the items shipped conform to the requirements of CDC's specification.

The certification, test data record and a copy of the manufacturer's packing slip, shall be forwarded to General Services - Purchasing, P.O. Box 117, Columbus, Ohio 43216-0017.

Purchasing Section will forward the certification and test data to MSTS for review and filing.

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/20/1992	**Quality Control - Monitoring**	Standard Number: **GS 2730.020(CG)** P&P 556-5
Supersedes: N/A		Page 2 of 2

5. PLANT INSPECTION

MSTS shall make periodic visits to inspect the manufacturer's facilities, testing procedures, and quality control records. These periodic visits will assure that the manufactured products and quality control procedures are in compliance with the applicable Index of Material Standards and the approved manufacturer's quality control plan.

MiSource

Gas Standard

Distribution Operations

Effective Date: 10/28/1992	**Initiating an Individual Work Order**	Standard Number: **GS 2810.010(CG)** P&P 623-3
Supersedes: N/A		Page 1 of 9

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE Columbia Gas System - Property Unit Manual
Code of Federal Regulations Title 18 - Parts 201-216

1. DEFINITIONS

Work Order

A method used to accumulate costs by project for studies and to accumulate Fixed Capital Asset costs by project for the installation, replacement, retirement and abandonment of Property Units.

There are two types of Work Orders:

Individual Work Order

This type requires that Forms C 242-1, “Work Order,” and C 242-2, “Work Order Completion Report,” be used to identify and accumulate costs by individual project, such as: the installation, retirement, or replacement of mains, buildings, regulator stations, the acquiring of land, etc.

Blanket Work Order

This type requires that Forms C 447-1, C 447-2, and C 447-4, “Blanket Work Order Completion Report - (See appropriate Form),” be used to accumulate the costs for certain recurring additions, retirements and replacement projects of a routine nature, such as: anodes, meter installations, service lines, service regulators, etc. (See CDC Chart of Accounts - Section H.) Refer to GS 6400.080(CG) “Accounting for Meter and Regulator Installation for Customer Accounting Billing (CAB) Customers,” for additional instructions.

Property Unit

A unit, or group of Minor Items of Property that make up a unit, which is used to identify Gas Plant installed or retired from Fixed Capital Assets in accordance with Federal Energy

Regulatory Commission (FERC) requirements.

The Property Unit identifies fixed capital items which are to be added to or retired from Gas Plant in Service. Construction or Retirement Work Orders must have a Property Unit installed or retired in order to be issued.

As of January 1, 1973, the Columbia Gas System Property Unit Manual was adopted as the source of prescribing and defining uniform Property Units. The units are based on, but not limited to, the Federal Energy Regulatory Commission (FERC) Units of Property for Use in Accounting for Additions to and Retirement of Gas Plant in Title 18, Chapter 1, Subchapter F, Part 216 of the Code of Federal Regulations.

Movable Property Unit

A Property Unit (e.g., a desk, chair, tools, etc.) that is not permanently attached to any permanent object and can be moved from place to place is defined as a “Movable Property Unit.” It is usually “placed” rather than "installed" and, since an Individual Work Order is generally used as a tool to collect installation costs, an Individual Work Order would not be necessary for the placement of Movable Property Units. Section II of the Columbia Gas System - Property Unit Manual contains a table indicating which Property Units are considered Movable Property Units.

Minor Items of Property

Minor items of property are associated parts or items (i.e., weld fittings, curb valves, location wire, windows, etc.) which make up Property Units (Retirement Units). When minor items are installed with Property Unit items, they are capitalized as “other costs” and are not identified (i.e., tees, nipples, location wire, windows, etc.). When installed separately, a Work Order is not required.

2. GENERAL

The Federal Energy Regulatory Commission (FERC) and state utility regulatory commissions require that gas utilities identify their fixed capital assets by Property Units (Retirement Units), and Gas Plant Accounts. Therefore, Work Orders shall be initiated to accumulate costs whenever:

a. A Property Unit is added to, retired from, or replaced in a pipeline facility.

b. A minor item of property is added to, retired from or replaced and a substantial addition (deletion) or betterment results.

Effective Date: 10/28/1992	Initiating an Individual Work Order	Standard Number: GS 2810.010(CG) P&P 623-3
Supersedes: N/A		Page 3 of 9

Work Orders shall also be initiated to accumulate costs for Preliminary Surveys and Investigations (Section 5.1) and Miscellaneous Maintenance and Jobbing Work (Section 5.2).

Work Orders are not initiated in connection with Movable Property Units because they are usually “placed” rather than “installed.”

3. PROPERTY UNITS

The Columbia Gas System - Property Unit Manual provides a complete listing of property units, descriptions and functions.

Examples of property units are as follows:

Pipe *	Shortstop **	Drip
Valve **	Insulating Fitting	Regulator
3 Way Tee **	Fence	Gauge
Mueller Fitting **	Lease	Heater

* An individual Work Order is required whenever pipe footage is added or deleted. If 50 feet or less of the same size and kind of pipe is replaced, a Work Order is not required.

** The installation of any shortstop, 3 way tee, or Mueller fitting smaller than 2 inch as part of a main (excluding measuring and/or regulator stations) does not require an individual Work Order, but a map revision is required.

Replacement of valves of same size and kind 2 inch or over in mains (excluding measuring and/or regulator stations), shall be accounted for through maintenance expense when such replacements are made strictly for repairs and the valve removed is replaced with a valve of like size and kind. If, however, the valve removed is worn out and beyond repair, the accounting for the replacement shall be through the appropriate Work Order. Also, if the replacement is made because of pressure or other operating conditions and the replacement results in adding a relatively costly valve of greater operating capacity, the replacement shall be accounted for through a Work Order.

Normally, work associated with a construction project is accomplished under a Specific Budget or Blanket Budget. Under each type, work follows the general categories of Gas Plant Accounts broken down in CDC's - Chart of Accounts Manual. For example, the installation of a district regulator station may require four Work Orders, as follows:

a. Secure regulator site.
b. Install inlet and outlet piping.
c. Install regulation.
d. Erect building.

4. WORK ORDER INITIATION

Work Orders are initiated by the operating Area or Department sponsoring the proposed work. The details of preparing and submitting Work Orders are explained in GS 2810.012(CG) "Work Order Preparation."

5. WORK ORDERS FOR SPECIAL ACTIVITIES

5.1 Preliminary Survey and Investigation (PS&I) Work Orders (Gen. Led. 183)

This Work Order category is used to accumulate costs prior to construction Work Order approval on such activities as special projects, feasibility studies, right of way acquisition, significant property survey work, line location and plan preparation, and design work on measuring stations. A PS&I Work Order can be used, where applicable, for investigations for replacements, corrosion protection and/or mitigation.

In situations where it is known that there is a reimbursable segment and a non-reimbursable segment on the same project, separate PS&I Work Orders are required for the respective segments.

PS&I Work Orders in this category are properly established under Account No.:

GEN. LED	BUD. NO. AUXILIARY	LOC. NO. SUBSID.	W.O. NO. Other
183	2000	* (3 Digit No.)	W.O. No. (4 Digit No.)

* If the PS&I work is reimbursable, a 7 should precede the Location No., with the name and address of the party being billed shown in the sketch area.

PS&I Work Orders cannot be cancelled. Form C 242-2, "Work Order Completion Report," shall be submitted showing the disposition of charges, either to an operating

and maintenance account or to a related construction Work Order. No construction material can be charged to a PS&I Work Order.

Complete details on the proper use of PS&I Work Orders can be found in Policy and Procedure Reference No. 380-4, "Preliminary Survey and Investigation Work Orders."

5.2 Miscellaneous Maintenance and Jobbing Work Orders (Gen. Led. 186)

As a general rule, Work Orders issued under this account should be limited to projects which are associated with or will be closed to work in progress (General Ledger Accounts 107 and 108). Some examples are:

a. accumulating costs relating to operating changes that may result in the abandonment or retirement of Company facilities;

b. accumulating costs of a temporary nature associated with reimbursable highway relocation projects, temporary pipeline installations, etc., pending installation of permanent facilities, which will be recorded in fixed capital;

c. accumulating costs for constructing or installing facilities which, upon completion, will be sold and for which the party billed requires a detailed description of materials used and expense incurred;

d. accumulating costs for damage claims;

e. accumulating costs for uprate Work Orders. (See Section 5.8.)

Normally, the costs specified in item "c" would be capitalized if CDC were to retain ownership. Projects for which the costs would be transferred to O & M (expense) if CDC were to absorb the costs may be included in General Ledger Account 186-1 only if they meet one or more of the above criteria and no other account is appropriate. The Asset Accounting Section shall be contacted for consultation prior to issuing Work Orders for borderline cases.

Miscellaneous Maintenance and Jobbing Work Orders are properly established under Account No.:

GEN. LED	BUD. NO. AUXILIARY	LOC. NO. SUBSID.	W.O. NO. Other
186	1	* (3 Digit No.)	W.O. No. (4 Digit No.)

* Use a 7 prefix for reimbursable projects and show instructions for billing on face of Work Order (sketch area).

Do not use a 7 prefix for damage claims Work Orders. The “Claim No.” shall be noted in the “Known As” block of Form C 242-1, “Work Order.”

5.3 Reimbursable Work Orders

A Work Order shall be issued whenever reimbursement for relocating existing facilities occurs. (Refer to GS 2850.010(CG) “Relocation Projects - Governmental Agencies,” GS 2850.012(CG) “Relocation Projects - Other,” and GS 2850.014(CG) “Relocation of Service Lines per Customer Request.”)

Identification of a reimbursable Work Order is accomplished by checking the appropriate block in the upper right hand corner of Form C-242-1, “Work Order,” and inserting a “7” for Construction Work Orders or an “8” for Retirement Work Orders in front of the “Location No.” In addition, the person and/or company to be billed shall be indicated in the Work Order sketch area.

Pertinent letters and/or agreements which explain the reimbursement arrangement shall be attached to the Work Order when submitting for approval and when completed.

Whenever circumstances change that affect the amount of reimbursement or eligibility for reimbursement, an approved reimbursable Work Order revision is required. Approval for the revision shall be at least the same level of approval as the original Work Order. The revised Work Order shall reflect the change in percentage of reimbursement or the deletion of the reimbursement prefix. See GS 2810.012(CG) “Work Order Preparation.”

A reimbursable Work Order is not taxable unless the reimbursement was made as a prerequisite to or an inducement for gas service. The status or identity of the customer is irrelevant. The "tax" is not applied to Work Orders involved with damage claims.

The reimbursement shall be classified as taxable or nontaxable whether or not a gross up, as indicated in the next paragraph, to recover the tax from the customer is required.

Only in Commonwealth of Virginia, where the cost of the tax is not currently recovered through rate base, shall the reimbursement be grossed up to recover the cost of the tax from the customer. The amount of the gross up is calculated by multiplying the Total Estimate by an Income Tax Factor obtained from GS 2810.030(CG) "Hourly Rates and Accural and Overhead Percentages Used in Calculating Costs." The tax collected is classified to account 421-0104 but is not reflected in the Work Order estimate.

5.4 Insulating Fittings and Valve Installations

The installation of insulating fittings and new main valves requires the issuance of 107 - Construction Work Orders but not a 108 - Retirement Work Order where the removal of sections of main eight feet or less are involved. Refer to GS 2810.020(CG) “Work Order Completion Reports” for instructions on the handling of the removed sections of main.

This accounting treatment is an exception for insulating fittings and new valve installations only.

5.5 Acquisition or Sale of Company Property

The sale or purchase of pipeline facilities and appurtenances within the Columbia System requires that Work Orders be submitted per applicable Company procedures.

For purchase or sale of pipeline and appurtenances to an outside party, the normal construction and retirement budgets shall be used. Exhibit A is an example of a letter which must be processed prior to a Work Order approval for the purchase or sale of property to outside parties. (See GS 2650.040(CG) "Assignment of Facilities From or to Others.”)

5.6 Right of Way Acquisition on a Specific Budget Project

A Work Order shall be issued to accumulate all charges associated with right of way acquisition connected with a Specific Budget. The work shall be identified by the assigned Specific Budget number.

5.7 Major River Crossing

The installation or abandonment of a major river crossing requires the issuance of an Individual Work Order. (See GS 2610.030(CG) or GS 2610.030(VA) “Notice to Non-Employees Using CDC's Maps.”)

5.8 Uprating Work Orders

The uprating of a system or part of a system requires the issuance of a 186-1, Miscellaneous Maintenance and Jobbing Work Order. A 186-1 Work Order for an uprating, while not reflecting any cost estimate, is used to:

a. Reflect facilities being uprated.

b. Establish a permanent record of uprating work performed.

c. Initiate DIS data based corrections by Finance - Customer Accounting.

d. List all related Work Orders.

While labor and/or material can be charged to a 186-1 Work Order, a Completion Report is required. The Completion Report must list the construction Work Orders and/or operating/maintenance accounts to be charged. See GS 2810.020(CG) “Work Order Completion Reports.”

5.9 Dig and Backfill Work Orders

A dig and backfill Work Order is issued whenever a project developer is permitted to provide comparable construction in lieu of a monetary commitment.

The equivalent construction contribution and offset shall be reflected on Form C 242-1, "Work Order." See GS 2810.012(CG) “Work Order Preparation.”

6. PROCESSING WORK ORDERS

The processing of initiated Work Orders shall be in accordance with local engineering processes.

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Gas Standard

Distribution Operations

Effective Date: 10/28/1992	**Initiating an Individual Work Order**	Standard Number: **GS 2810.010(CG)** P&P 623-3
Supersedes: N/A		Page 9 of 9

EXHIBIT A

TO: MANAGER, ENGINEERING - LAND SECTION

FROM: DISTRICT MANAGER

RE: APPROVAL FOR SALE/PURCHASE

Approval is requested for the proposed sale/purchase of the facilities indicated on the attached map or sketch.

The sale/purchase is justified for the following reason(s):

Indicate sale or purchase price $ _____

Reviewed: Civil Engineering, Director Date By

Reviewed: Facilities Planning, Director Date By

Work Order Number:_____Plat Number

Approved:
Company President

Approved:
Vice President, Engineering

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Gas Standard

Distribution Operations

Effective Date: 05/27/2008	**Work Order Preparation**	Standard Number: **GS 2810.012(CG)** P&P 623-4
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Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. FORM C 242-1, "WORK ORDER"

Work Orders shall be prepared on Form C 242-1, "Work Order," in accordance with instructions found in Exhibit A. Work Sheets used in estimating various costs for entry on the Work Order may be retained locally for back-up.

2. WORK ORDERS WHICH REQUIRE NO COST ESTIMATE

The following is a list of Work Order types which do not require a cost estimate:

Sites for regulators, rectifiers or groundbeds (Budgets 575, 576) (GS 2650.030(CG) "Acquiring/Disposing of Land And Land Rights")

Preliminary Survey and Investigation (183-2000)

Miscellaneous Maintenance and Jobbing (186-1)

Securing Right-of-Way (Specific Budgets)

Uprating (Budget 186-1)

3. WORK ORDER REVISIONS

When Management approves a Work Order, the expenditure is approved for the "Total Estimate" plus or minus 10% or $5,000, whichever is greater. It is the obligation of the person in charge of the work to notify Management of a revision as soon as possible to provide Management the opportunity to re-evaluate the original approval under the new circumstance(s).

There are two methods of notifying Management of a revision, depending on when the need becomes apparent.

3.1 Non-reimbursable Work Orders

3.1.1 Prior To or During Construction

When it is recognized that the "Total Estimate" will be over/under the authorized amount, prefer-ably prior to or during construction, a revised Work Order shall be prepared and the "Work Order Control System" updated.

A revised Work Order to show design changes, and/or new cost estimates is prepared in the same manner as the original Work Order, except that it will use the original Work Order number, to indicate that it is a revised Work Order, and include an explanation in sketch area or on an attached memorandum.

To update the "Work Order Control System" either of the following actions is required:

a. Log on and make necessary corrections.

b. Submit a new Form C-1527, "Work Order Control Card," marked "Revision" in top left corner.

3.1.2 After Construction is Completed

In those cases where the "Total Estimate" is not deter-mined to be over/under the authorized amount until after construction is completed, the Work Order need not be revised. An explanation can be included with the completion report in accordance with GS 2810.020(CG) "Work Order Completion Reports."

3.2 Reimbursable Work Orders

When Management previously approved a reimbursable Work Order, the approval was based on the amount of reimbursement and the Company's eligibility for reimbursement. Therefore, if either basis for approval changes a Work Order revision shall be prepared and the "Work Order Control System" updated after approval.

4. RELATED FORMS

Various forms and/or documents related to the Work Orders shall be handled as follows:

4.1 Form C-2404, "Main Evaluation Data"

Form C-2404, "Main Evaluation Data," (Exhibit F), is used to consolidate data on

condition, history, and other information needed to make an evaluation and arrive at a repair/replace decision in accordance with GS 1460.010 "Corrosion Remedial Measures – Distribution" or GS 1460.020 "Corrosion Remedial Measures – Transmission Lines."

Budget 557 Work Order requests having cost estimates greater than $25,000 shall have Form C 2404 attached when submitted to Engineering - Facilities Planning for approval.

4.2 Line Extension Agreement

Budget 555 Work Order requests having cost estimates greater than $25,000 shall have the applicable Line Extension Agreements attached when submitted to Engineering - Facilities Planning for approval.

Refer to Exhibit A, Keys 9 and 10 for additional information.

4.3 Form C-1434, "Request for Service to Civil Engineering and/or Land Section"

Form C-1434, Exhibit D, shall be submitted directly to Engineering - Civil Engineering when survey, land services, or permit acquisition assistance is to be requested.

Refer to GS 2650.040(CG) "Assignment of Facilities From or to Others" and GS 2200.040(CG) "Rail-road Occupancy Requirements" for additional information.

4.4 Subdivision Plats

Subdivision plat maps should be forwarded to Engineering - Graphics Section as soon as available to facilitate development of base maps.

4.5 Regulator(s)/Meter(s) Sizing Data

Budget 573 and 583 Work Order requests having cost estimates greater than $25,000 or involving the purchase, or exchange of gas volumes shall have Form C-2485, "Regulator(s)/Meter(s) Sizing Data" or a Station Design Memorandum attached when submitted to Engineering - Facilities Planning for approval.

Refer to Exhibit A, Key 38 for additional information.

4.6 Form C 1910, "Commercial/Industrial Application and New Load Data"

Attached to Budget 555 Work Orders, when appropriate.

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Instructions for completion of Form C 242-1, "Work Order."

The following items are keyed to Form C 242-1, page 16 of this Exhibit, and each blank must be completed if appropriate. If inappropriate, space shall be left blank.

Key	Item	Description
1	Company	Check appropriate company block.
2	Work Order Action	Check appropriate block(s), if: REIMBURSABLE - prefix location number with a 7 for construction Work Orders and 8 for retirement Work Orders. VERBAL - Indicate when work was started prior to Work Order approval and reflect initials of person granting approval and date. REVISED - Indicate date revision was issued, for additional information, refer to Section 3 of this procedure.
3	Date Issued	Enter date when Work Order was assigned a number.
4	District	Self-explanatory
5	Division	Leave blank.
6	Area	Enter name and/or number of local operating Area.
7	Job Location	Provide a brief description of exact location of proposed work, giving street or road name, etc.
8	Known As	Enter identification number of Company facility involved; i.e., "D" line number, regulator number, measuring station number, rectifier number, lease or deed number, building number, valve number, damage claim number, etc. If no numbered Company facility is involved, enter "NONE."

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Key	Item	Description
9	Classification Block	Complete as follows: Gen. Led. - indicate type Work Order; i.e., 107 (construction and installation), 108 (retirement or removal), 183 (Preliminary Survey and Investigation), 186 (Misc. Maint. & Jobbing Work). Bud. No. - indicate budget number. Loc. - enter location number of sponsoring area with the first digit (region number) eliminated. Note: Prefix location number: with a — to indicate 6 — Customer advances for construction, 252 Account (Line Extension Agreement Work Orders) 7 — Construction reimbursable Work Order 8 — Retirement reimbursable Work Order W.O. No., - enter the Work Order number assigned by District office.
10	Proposed Work	Provide a brief description of work to be done. Start with an action word such as lay, construct, abandon, etc.

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Gas Standard

Distribution Operations

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Key	Item	Description
10	Proposed Work (Cont')	Examples: Lay 200 feet of 4 inch L.P. main; Install District Regulator Station; Insert 160 feet of 2 inch plastic pipe through reclaimed 3 inch casing; Abandon 321 feet of 3 inch M.P. main; Construct 10' x 10' Conc. Blk. Reg. Bldg.; Acquire Regulator Site. Serve 4 residential applicants For reimbursable Work Orders indicate percent of "Total Estimate" (Key 25) to be billed. Indicate amount received as a customer advance for construction, 252 Account (Line Extension Agreement Work Orders).
11	Plant Acct. No.	To be completed by Finance - Asset Accounting, when applicable.
12	Purpose and Necessity	Enter reason for work that corresponds to a Retirement Code number (See Key 13). Key words such as "inadequate size"; "deteriorated"; "to provide"; "required by"; "damaged by"; etc., should be used. If more than one reason, mention all reasons. For projects related to highway construction, include highway authority project code number. Examples: Line deteriorated beyond feasible repair. To protect District Regulator. In the way of shopping center construction. To replace 2 inch pipe which has inadequate capacity.

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Key	Item	Description
12	Purpose and Necessity (Cont'd)	For line extension projects involving commercial and industrial applicants indicate New Load Data Sheet Number. Example: To serve one new commercial customer (name), New Load Data Sheet No. __ For line extensions projects indicate number of actual applicants to be initially served. Example: To serve seven residential applicants.
13	Ret. Code	Enter Retirement Code number from Exhibit B that corresponds to Purpose and Necessity (Key 12).
14	L.E.A. Number	Enter line extension agreement (L.E.A) number when one is required. When a L.E.A. is not required, enter an abbreviated statement to that effect, such as No Dep. Req. If a new load and no L.E.A. is required, enter new load data sheet number.
15	Incorporated Place or County Subdivision	Enter name of incorporated City, Town, Village or name of Township or District. If proposed work covers two or more Communities, Townships or Districts, enter the one where the majority of proposed work is located.
16	Taxing District Number	Enter Taxing District number. The Taxing District number can be obtained from the on-line District table in DIS (65). If proposed work involves two or more taxing districts, enter the one where the majority of proposed work is located.

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Key	Item	Description
17	County	Self-explanatory
18	State	Self-explanatory
19	Related Work Order Numbers	List all related Work Order numbers, including Preliminary Survey and Investigation Work Order. Example: Related Work Orders to replace regulator and setting may be as follows: 183-2000-(Loc. No.) - (W.O. No.) 108-584-(Loc. No.) - (W.O. No.) 107-585-(Loc. No.) - (W.O. No.) 108-586-(Loc. No.) - (W.O. No.) 107-559-(Loc. No.) - (W.O. No.) 108-560-(Loc. No.) - (W.O. No.) If space is inadequate, write “See Below” and list related Work Order numbers in sketch area.
20	Cost Estimate - Materials	Complete as follows: a. Property Units - Description - List property units such as pipe, valves, regulators, gauges, shortstops, shortstop tees, buildings, fences, heaters, etc. Give wall thickness and grade of pipe, figure number of valves, model number of regulators, etc. A list of the property units is included in Section II of the Columbia Gas System Property Unit Manual.

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Key	Item	Description
20	Cost Estimate - Materials (Cont'd)	Note: On retirement Work Orders, specify what disposition will be made of the material or equipment being retired, such as “abandon in ground,” “to junk,” “reclaim as conduit,” etc. No price is shown for material being retired.

b. Size - List each type of property unit individually, starting with largest size first; such as 6 inch pipe, 4 inch pipe, 2 inch pipe, 6 inch valve, 4 inch valve, etc.

c. Quantity - Self-explanatory

d. Unit Price - Indicate cost per foot for pipe, cost per valve, etc. Prices may be secured from the “Material and Supplies Transaction Report” distributed monthly by the Purchasing Section.

e. Amount - Enter total for each item rounded to nearest dollar.

f. Miscellaneous Fittings and Material - Enter total amount of non-property units such as fittings, pipe coating, anodes, joint patching, welding material, test station heads, etc. Any significant cost item may be separately identified whether it is a property unit or not. Form C 1341-1, “Bill of Material,” (Exhibit C), may be used to make a complete listing of fittings and miscellaneous material (in addition to property units) to arrive at a dollar amount and to advise the Area Warehouse personnel to obtain and accumulate the materials required.

g. Total Material - Enter total estimated cost of material. This figure is used as the basis for calculating Stores Expense and Freight Charges.

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Key	Item	Description
21	Other Costs	Complete as follows: a. Stores Expense and Freight - Enter current percentage rate. (Refer to GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs") and apply to Key 20g and enter resultant figure. b. Special Backfill and Paving Materials (Purchased by Company) - Enter total estimated cost of stone chips, dust, asphalt, blacktop, concrete and other materials to be company purchased. Materials purchased by contractor as part of the contract are not included. c. Labor - Company - Calculate by multiplying the total estimated man-hours by the average rate per hour to obtain "raw labor." Multiply "raw labor" figure by the current percentage for "Vacation and Non-Productive Time Accrual." (Refer to GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs.") Add the resultant amount to "raw labor" amount to arrive at "Labor-Company" estimate. Percentage figure used shall be shown. Construction and Retirement Work Orders require a Labor-Company estimate except as noted in Section 2. d. Labor Overheads - Calculate by multiplying Key 21c estimate by the Labor Overhead percentage (Refer to GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs.") Percentage figure used shall be shown.

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Key	Item	Description
21	Other Costs (Cont'd)	e. Outside Labor - Enter an estimate of charges to include expenses to be paid highway inspectors, and policemen to control traffic, etc.
		f. Contract - Enter amount to be paid to outside firms and individuals for services to be performed under contracts. Provide contractor name(s) and contract number(s) if known. For a dig and backfill agreement, enter the equivalent construction contribution. See Key 21k.
		g. Right-of-Way Costs - Enter "Consideration" and expenses other than Company labor incident to securing rights-of-way. Engineering - Land Section will supply estimates if significant costs are anticipated.
		h. Damages (Right-of-Way) - Enter estimate of damages to be paid to property owner as a result of construction. Engineering - Land Section will supply estimates if significant costs are anticipated.
		i. Vehicles and General Tools - Calculate by multiplying rate per hour of each type vehicle and general tool to be used by the estimated number of hours of use. Add the resultant amounts to arrive at total. (Refer to GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs" for rates.)
		j. Supplies, Misc. and Other Costs - Enter cost of small hand tools, various supplies and materials, travel expense, meals, etc.
		k. When a dig and backfill contribution is entered under Key 21f, an offsetting credit is made by the notation "Aid-in-construction - Dig and Backfill" and entering a negative offsetting figure.

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Key	Item	Description
22	Total-Material and Other Costs	Enter total of Key 20g and Keys 21a thru j.
23	Allowance for Funds Used During Construction	Enter current percentage rate (30 day or 15 day rate reflected in GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs") and apply to Key 22 and 24 to arrive at figure. Example: Assume Work Order to be open 6 months, then figure to be entered equals (Key 22+24) x 30 day rate x 6 months. Note: Not to be applied to retirement Work Orders.
24	Supervision, Engineering, General and Administrative	Enter current percentage rate (Refer to GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs") and apply to Key 22 to arrive at figure. Note: Not to be applied to retirement Work Orders.
25	Total Estimate	Enter total of Keys 22, 23 and 24.
26	Special Services	Check box for service required. If Engineering Department services are required Form C 1434, "Request for Service to Civil Engineering Graphic and/or Land Section," (Exhibit D), shall be submitted directly to the Engineering - Civil Engineering, Director with a copy of the Work Order.
27	Permits Required	Check boxes to indicate permits needed. If permit will be acquired through Engineering - Land Section, Form C 1434, "Request for Service to Civil Engineering Graphic and Land Section," shall be sent directly to the Director of Civil Engineering with a copy of the Work Order. If a permit is to be obtained locally, indicate this by placing an asterisk after type of permit checked.

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Key	Item	Description
28	Market No. Affected	Check appropriate box. If "No," no further action is required. If "Yes," list Market Numbers affected and submit the original Work Order to Engineering - Facilities Planning for approval. Work that may affect a change in Market Number might typically be when: a. Points of Delivery are added or deleted, b. Markets are combined or separated. c. Measurement is added or deleted from a Point of Delivery. Note: The first five digits of the Main Number (first two indicate Company next three indicate Market) taken collectively are referred to as the Market Number. Refer to CDC's Reference Guide-Glossary.
29	Systems Affected	Check appropriate box. If "No," no further action is required. If "Yes," list Systems affected and submit original Work Order to Engineering - Facilities Planning. Work that may affect a change might typically when: a. an entire system (or portion) is uprated or downgraded from one pressure designation to another. b. a system is added.

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Key	Item	Description
29	Systems Affected (Cont'd)	c. systems are combined. d. a portion of a system is separated from one system to form a new system or combined with another system. Note: A system or systems comprise a Market. The sixth through eighth digits of the Main Number identify the system. Refer to CDC's Reference Guide-Glossary.
30	Number of Potential Applicants on Proposed Extension	Indicate number of potential applicants who could apply for service off extension. Note: Indicate classification (residential - R, commercial - C, and industrial - I) of potential customers. Example: 7R, 2C, 1I.
31	Other Potential Customers	Indicate number of potential customers who could be served from extension by classification (residential - R, commercial - C, and industrial - I) of potential customers. Example: 7R, 2C, 1I. Note: If larger size pipe is requested to meet sizing requirements of a master plan then an explanation shall be attached.
32	Work Will Be Started	Indicate month and year start of work is anticipated.
33	Work Will Be Completed	Indicate in service date anticipated (or date placed in service).
34	Prepared By	Name of person who prepared Work Order.

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Key	Item	Description
35	Reviewed By	Name of first supervisor who reviews Work Order.
36	Approvals	Signed at each level of approval in accordance with the Manual of Managerial Approval.
37	Method of Tie-in	Reflect method of tie-in as specified by the Operations Engineer.
38	Sketch	The following applies to all Work Order type sketches, as appropriate: a. Indicate Operation (or TCO Inventory) map number which contains area in which work will occur. b. Draw sketch with north towards top of sheet, when possible, and add pointer to compass rose to indicate north. c. When sketch will not fit sketch area of Form C 242-1, Form C 1914, “Supplemental Request/Completion Sketch,” Exhibit E, is recommended. If Form C 1914 is not used, an 8 1/2" x 14" sketch sheet can be used. It shall reflect the following information: district, division, area, north, map number, and Work Order number. d. Sketches need not be drawn to scale but should be drawn neatly and clearly. e. A distinct dark black line is required for reproduction. A pencil may be used. f. Indicate Taxing District boundary line(s), if applicable.

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Key	Item	Description
38	Sketch (Cont'd)	The following applies to specific Work Order types as follows:

a. Construction and retirement Work Orders require:

1. that the sketch contain all tie-in or terminal points and relate platted streets, railroads, water crossings, etc. in work area.
2. that lines to be installed or retired appear as dashed lines, unaffected lines as solid lines.
3. that all gas lines in work area be reflected.
4. that size, kind, type, and pressure type (LP, IP, etc.) of all lines be reflected along with footage detail of affected line(s).
5. that property units affected be reflected (Refer to GS 2810.010(CG) "Initiating an Individual Work Order.")
6. that water crossing be detailed to reflect construction considerations. When necessary use a separate sketch.

   Note: Major river crossings require a separate Work Order (Refer to GS 2200.010(CG) "River and Stream Crossings").
7. that cathodic protection measures be indicated, as applicable.

c. New business extension reflect footages for which no deposit was taken (except for allowances for approved applicants.)

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Key	Item	Description
38	Sketch (Cont'd)	c. Land procurement and building Work Orders require only a location sketch. When the procurement of land is for a regulator site the Operations Engineer should insure that the sketch reflects a primary site location and alternative locations. Refer to GS 2300.010 "Regulator Station Design - 1" Regulators" or GS 2300.020 "Regulator Station Design - 2" and Larger."
		d. Regulator and measuring station Work Orders shall have a location sketch, and a sketch reflecting inlet and outlet mains, and Form C 2485, "Regulator(s)/ Meter(s) Sizing Data," (see below) affixed or a copy of a "Station Design Memorandum," Exhibit G.

REGULATOR(S)/METER(S) SIZING DATA

Regulator(s) Data		
	Monitor	Control
Manufacturer	_____	_____
Size/Type	_____	_____
Flange Rating	_____	_____
Inner Valve Size	_____	_____
Spring Range	_____	_____
Diaphragm Size/Pilot		
Meter(s) Data		
Manufacturer	_____	
Quantity/Size/Type	_____	
Metering Pressure	Max _____ Min _____	
Design Data		
	Maximum	Minimum
Inlet Pressure (Psig)	_____	_____
Outlet Pressure (Psig/"W.C.)	_____	_____
Load, MCF/Hr. *		
Std. Dwg. No.(s)		

FORM C 2485 CSD (8-88)

* Capacity shall reflect the peak hour from a Network Analysis study, Load Data sheet, or other appropriate load requirement.

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Key	Item	Description
38	Sketch (Cont'd)	e. Preliminary Survey and Investigation (PS&I), and Miscellaneous Maintenance and Jobbing Work Orders normally do not require a sketch. However, in some cases, it may be beneficial to use a sketch to define the limits of the work area. The sponsor name of a PS&I Work Order shall appear in the sketch area. f. Reimbursable Work Order shall reflect the name and address of person, amount to be billed and whether any advance payments were made. (Refer to GS 2810.010(CG) "Initiating an Individual Work Order," and 525-3, "Damage to Company Pipeline Facilities.") g. Uprate Work Order shall reflect in addition to the sketch the following information: MAOP System Number System Name MOP Accountability Code Location No.(s). Taxing District No(s).
39	Pressures	a. Test - Indicate pressure at which component being constructed will be tested. Normally this pressure will be 90 psig. Refer to GS 1500.010 or GS 1500.010(OH) "Pressure Testing." b. MAOP - Indicate Maximum Allowable Operating Pressure (MAOP) of system in which gas facilities are to be installed. Indicate proposed MAOP on Work Orders involving an uprating (Refer to GS 1660.020 "Maximum Allowable Operating Pressures (MAOP)").

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Key	Item	Description
39	Pressures (Cont'd)	c. Max. Oper. - Indicate maximum operating pressure affected system actually experienced in recent past on all Work Orders involving installation of gas facilities.
40	Installation Code	Enter appropriate installation code:

Code	Explanation
A.	Pipeline Work - Company - All work associated with Work Order provided by Company personnel.
B.	Pipeline Work - Contract - All work associated with Work Order provided by outside contract except Company inspection of facility.
C.	Pipeline Work - Contract - All work associated with Work Order provided by outside contract except Company inspection and tie-in of facility.
D.	Pipeline Work - Company and Contract - All work associated with Work Order provided by Company personnel except restoration of surface damage performed by contract (paving, sod, seed).
E.	Pipeline Work - Other - All other pipeline work not covered by codes A through D.
F.	All Other Than Pipeline Work
G.	Pipeline Work - Dig and Backfill - All work associated with Work Order provided by Company personnel except trenching and backfilling.

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Gas Standard

Distribution Operations

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Key	Item	Description
41	Network Analysis No.(s) (Main Number)	Enter the first eight digits of the Main Number and, if available, load location type (1 digit) and load location identification (4 digits). If not a current study identified by a Main Number, list the network analysis number.
42	Certificate	Signature of responsible engineering representative (engineer or engineering technician) on all installation, retirement, and regulator site Work Orders.

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FORM C 242 1 CPS #491

☐ CKY ☐ CMD ☐ CPA (1)
☐ COH ☐ COG

COLUMBIA GAS DISTRIBUTION COMPANIES
WORK ORDER

(2) ☐ REIMBURSABLE ☐ VERBAL _____ ☐ REVISED-DATE _____

DATE ISSUED	DISTRICT	DIVISION	AREA	GEN LED	BUD NO AUX	LOC SUBSID	W O NO OTHER
(3)	(4)	(5)	(6)			(9)	

JOB LOCATION (7) — KNOWN AS NO (8)

PROPOSED WORK (10) — PLANT ACCT NO (11)

PURPOSE AND NECESSITY (12) — RET CODE (13) — L.E.A. NUMBER (14)

INCORPORATED PLACE OR COUNTY SUBDIVISION (15) — TAXING DISTRICT NUMBER (16) — COUNTY (17) — STATE (18)

RELATED WORK ORDER NUMBERS (19)

COST ESTIMATE - MATERIALS

PROPERTY UNITS-DESCRIPTION	SIZE	QUANTITY	UNIT PRICE	AMOUNT
(20-A)	(20-B)	(20-C)	(20-D)	(20-E)
MISCELLANEOUS FITTINGS AND MATERIAL				(20-F)
TOTAL MATERIAL				(20-G)

OTHER COSTS

STORES EXPENSE AND FREIGHT (%)	(21-A)
SPECIAL BACKFILL AND PAVING MATERIAL (Purchased by Comapny)	(21-B)
LABOR COMPANY (Including Vac. Accural, Non-Prod. Time (%)	(21-C)
LABOR OVERHEADS (%)	(21-D)
OUTSIDE LABOR (Highway Inspectors, Policemen, Etc.)	(21-E)
CONTRACT	(21-F)
CONTRACT	
RIGHT-OF-WAY COSTS (Other than Labor)	(21-G)
DAMAGES (Right-Of-Way)	(21-H)
VEHICLES AND GENERAL TOOLS	(21-I)
SUPPLIES, MISC., AND OTHER COSTS	(21-J)
(SEE TEXT FOR DIG AND BACK FILL INSTRUCTIONS)	(21-K)
TOTAL-MATERIAL AND OTHER COSTS	(22)
ALLOWANCE FOR FUNDS USED DURING CONTRUCTION (%)	(23)
SUPERVISION, ENGINEERING, GENERAL & ADMINISTRATIVE (%)	(24)
TOTAL ESTIMATE	(25)

DATA

SPECIAL SERVICES ☐ SURVEY ☐ LAND (26)

PERMITS REQUIRED (27)
☐ RAILROAD ☐ HIGHWAY ☐ TOWNSHIP
☐ BRIDGE ☐ STATE ☐ CITY
☐ WATERWAY ☐ COUNTY ☐ OTHER _____
*INDICATES PERMITS OBTAINED LOCALLY

MARKET NO. AFFECTED ☐ YES ☐ NO LIST NO'S AFFECTED (28)

SYSTEMS AFFECTED ☐ YES ☐ NO LIST NO'S AFFECTED (29)

NUMBER OF POTENTIAL APPLICANTS ON PROPOSED EXTENSION (30) — OTHER POTENTIAL CUSTOMERS (31)

WORK WILL BE STARTED (32) 19 — WORK WILL BE COMPLETED (33) 19

PREPARED BY (34) 19
REVIEWED BY (35) 19

APPROVALS

(36)	19
	19
	19
	19
	19
	19
	19

METHOD OF TIE-IN (37)

INDICATE NORTH — SKETCH — MAP NO _____

(38)

PRESSURES TEST	PRESSURES MAOP	PRESSURES MAX OPER	INSTALLATION CODE	NETWORK ANALYSIS NO.(S) (MAIN NUMBER)	CERTIFICATE: I CERTIFY THAT ALL COMPONENTS ON THIS PROJECT ARE DESIGNED IN ACCORDANCE WITH THE COLUMBIA GAS DIST. COMPANIES POLICY/PROCEDURE MANUAL
_____	(39)	_____	(40)	(41)	ENGINEER (42)

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EXHIBIT B
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Classification of Reasons for Retirements of Fixed Capital

1. EXHAUSTION OF OR A DECREASE IN LOCAL NATURAL GAS SUPPLIES - where the retirement is a removal of property no longer useful at its present location because of a decrease in or the exhaustion of local gas supplies (including both gas produced by the Company and gas purchased from other local producers). Such property includes gas wells, pipe lines, pumping equipment and meters to gather, transmit, and measure the gas.

2. INADEQUACY - where the retirement results from insufficiency in present facilities to provide for what is required or needed. Such inadequacy is more common in pipe and equipment transporting natural gas, but some or parts of building construction equipment, furniture, etc., may become inadequate. Volumes of natural gas required by customers may necessitate greater capacities to supply the immediate vicinity, areas beyond the immediate vicinity and future anticipated requirements.

3. DETERIORATION - where the retirement results from decline in usefulness and loss in value due to the action of the elements, wear and tear, decay and corrosion. A common occurrence of deterioration is the corrosion and pitting of underground pipe and fittings.

4. CHANGE IN PLAN OF OPERATION - where the retirement is occasioned by a necessity for a rearrangement of property to allow for the more efficient use of existing equipment. This includes removals necessary to provide space for a new facility or installation, such as valve settings, drips, branch line tie-ins, measuring stations and equipment which are physically in the way of such new facility or installation. Such removals should not be confused with those due to inadequacy, as the new installations made within the present limits of units such as pipe lines or compressor stations, are normal occurrences. This classification includes retirements caused by removals of temporary installations and retirements caused by decisions of management which are not properly includable under any of the other reasons.

5. OBSOLESCENCE - where the retirement results from the equipment having become antiquated or superseded by reason of modern equipment; is no longer capable of performing economically the work originally intended due to its design or principle; or when the equipment has become excessively difficult and expensive to maintain, and its replacement will result in greater efficiency and economy. Examples of obsolescence are where repair or replacement parts are no longer available; or even though repair parts are

EXHIBIT B
(2 of 3)

available, it may be considered inadvisable to incur the expense because more efficient equipment is now manufactured.

6. REQUIREMENTS OF PUBLIC AUTHORITY - where the retirement is occasioned by removals and relocation necessitated by public improvements such as dams, reservoirs, highways, streets, sewers, water mains, electric conduit and other underground structures. This reason should also include removals in anticipation of possible future interference with public improvements.

7. REQUIREMENT OF OTHERS - where the retirement is occasioned by action of private enterprises (other utilities, companies, partnerships, or individuals) necessitated by the nature and requirements of their business such as water, telephone or electric service, strip mining, private housing developments, industrial developments, etc.

8. DAMAGES AND DESTRUCTION - where the retirement results from landslides, storms, fire, explosions, etc., which necessitate a replacement or relocation of the retired property, wholly or in part. This classification is also to include items lost or stolen.

9. PRECAUTIONARY MEASURES - where the retirement results from removals which are necessary on account of hazards to Company operation, property or life. Examples of this classification are buildings or other improvements so close to the pipe lines that a removal and relocation is advisable to safeguard both property and life.

10. SALES OF PROPERTY - where the retirement is the result of sales of property the loss from which, if any, is chargeable to the depreciation reserve. Such retirements are to be classified as a sale or trade only if the property is to be continued in its same use following the transaction and would not be removed from the plant account at or near that time if the transaction had not taken place.

11. UNCODED - OTHER - where the retirements are accumulated under blanket work orders, the individual charges to which are not separately identifiable as to cause for removal. Also where retirements and retirement reversals are made to bring the books into agreement with maps or physical inventories and such adjustments cannot be traced to a fault in any previous entry for an addition, retirement or fixed capital adjustment.

19. REJECTS - where retirements are made from non-depreciable accounts such as land which are not analyzed for salvage study purposes. Also, for adjustments to write-offs

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(both book cost and salvage elements) made prior to the study period. The isolation of such entries, usually consisting of only one element of the write-off, either book cost or salvage, keeps such adjustments from distorting the ratio or salvage to book cost.

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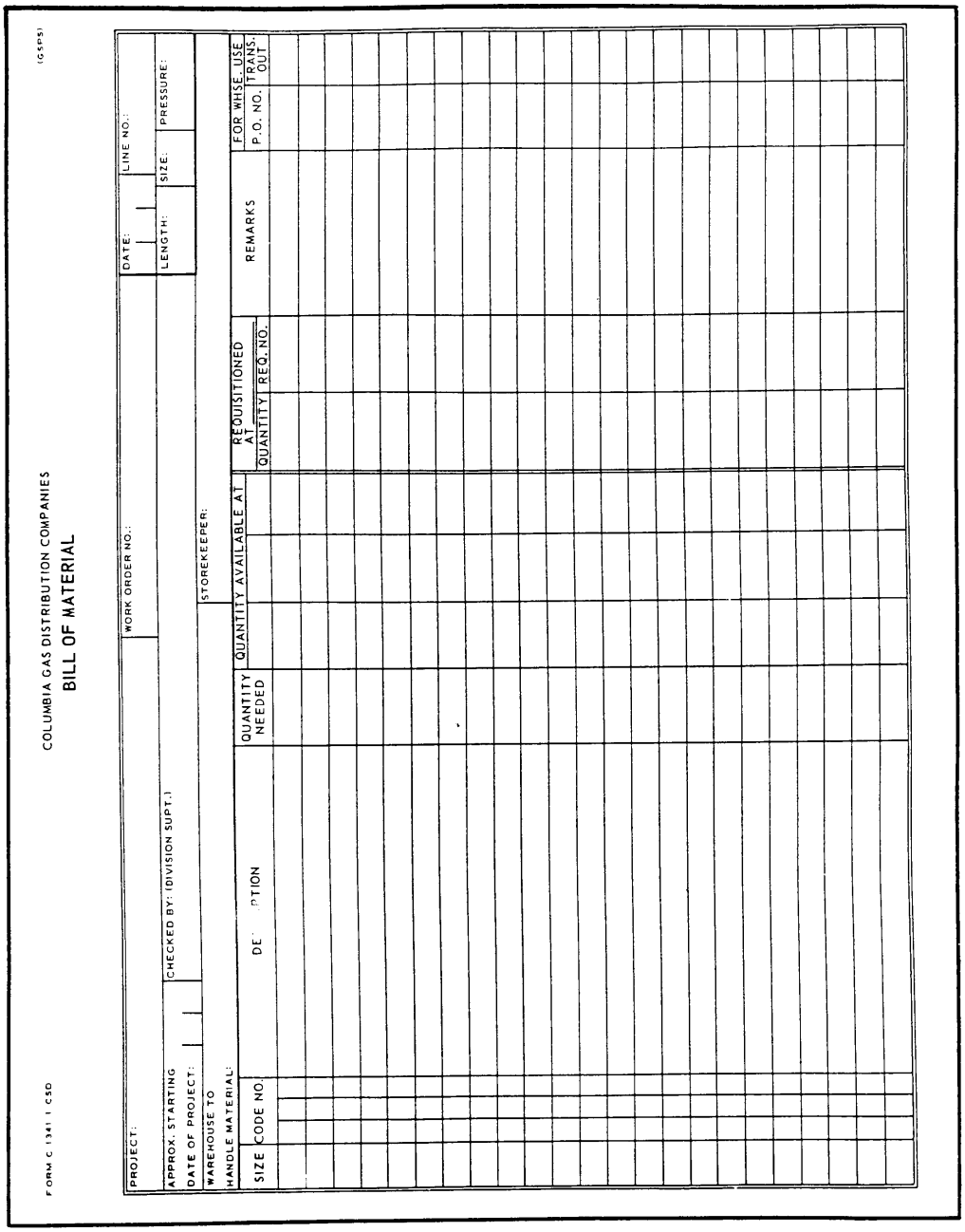
EXHIBIT C



COLUMBIA GAS DISTRIBUTION COMPANIES

BILL OF MATERIAL

PROJECT:

WORK ORDER NO.:

DATE:

LINE NO.:

LENGTH:

SIZE:

PRESSURE:

APPROX. STARTING DATE OF PROJECT:

CHECKED BY: (DIVISION SUPT.)

WAREHOUSE TO HANDLE MATERIAL:

STOREKEEPER:

SIZE	CODE NO.	DESCRIPTION	QUANTITY NEEDED	QUANTITY AVAILABLE AT	REQUISITIONED AT QUANTITY	REQ. NO.	REMARKS	FOR WHSE. USE P.O. NO.	TRANS. OUT

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EXHIBIT D

COLUMBIA GAS
Distribution Companies

REQUEST FOR SERVICE
TO CIVIL ENGINEERING AND/OR LAND SECTION

DATE ISSUED _____

MAP NO. _____

JOB NO. _____ (C.E. & L. ONLY)

ACCOUNT CLASSIFICATION

CO	GEN	AUX	CE	PROJ	ACTIV	FACIL	HCC	TCC	LOB

COMPANY: ☐ CKY ☐ COH ☐ CMD ☐ COS ☐ CPA DEPT. OR DIST. _____ AREA OFFICE _____

SURVEY _____ RAILROAD CROSSING PERMIT _____

EASEMENT OR R/W _____ STREAM CROSSING PERMIT _____

HIGHWAY PERMIT _____ OTHER _____ (DESCRIPTION)

ACQUIRE SITE _____ EXISTING AGREEMENT NUMBER _____

PROJECT LOCATION _____

PROJECT DESCRIPTION _____

CONSTRUCTION WILL START _____

FOR PROJECT DETAILS CONTACT _____ AT _____ (LOCATION)

REQUESTED BY _____

REMARKS _____

FORM C 1434 CPS (11-82)

NOTE: ATTACH WORK ORDER COPY OR SKETCH

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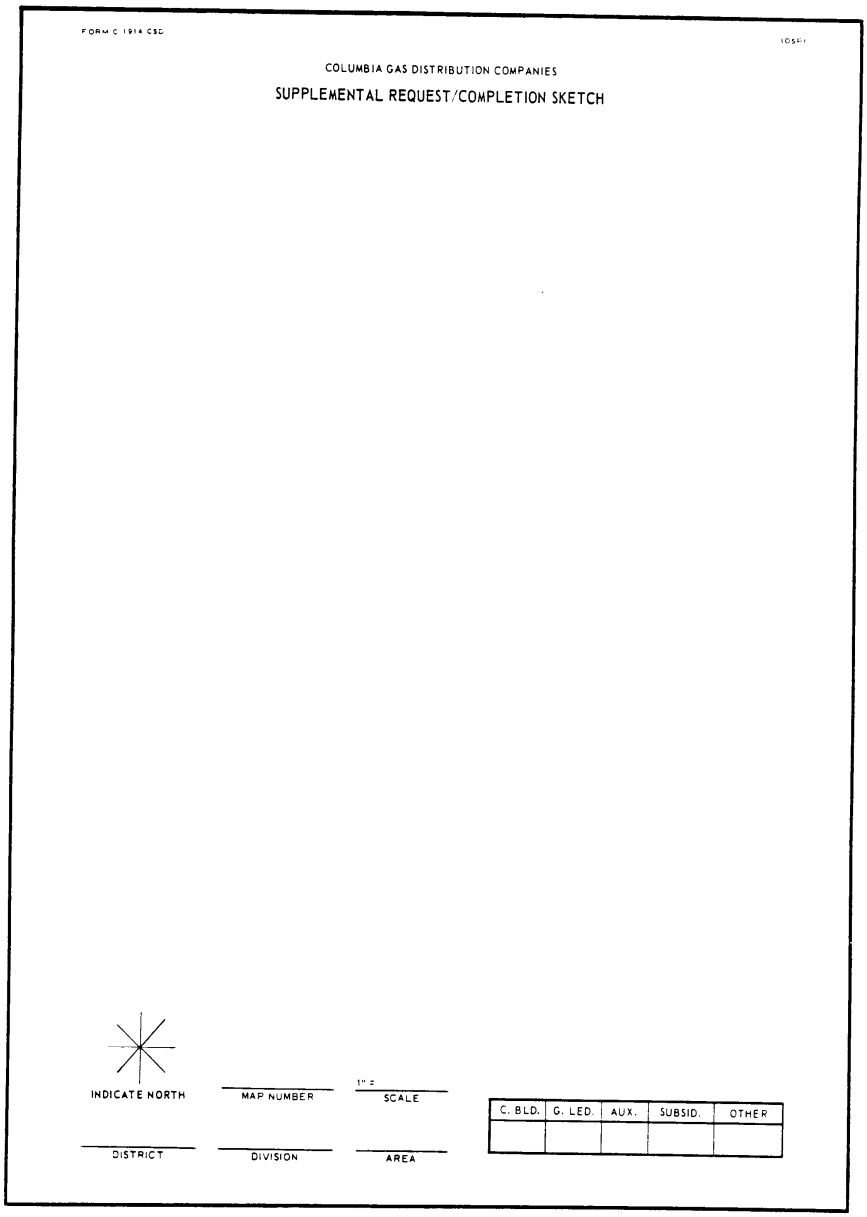
EXHIBIT E



FORM C 1914 CSC

(OSF)

COLUMBIA GAS DISTRIBUTION COMPANIES

SUPPLEMENTAL REQUEST/COMPLETION SKETCH

INDICATE NORTH

MAP NUMBER

1" =

SCALE

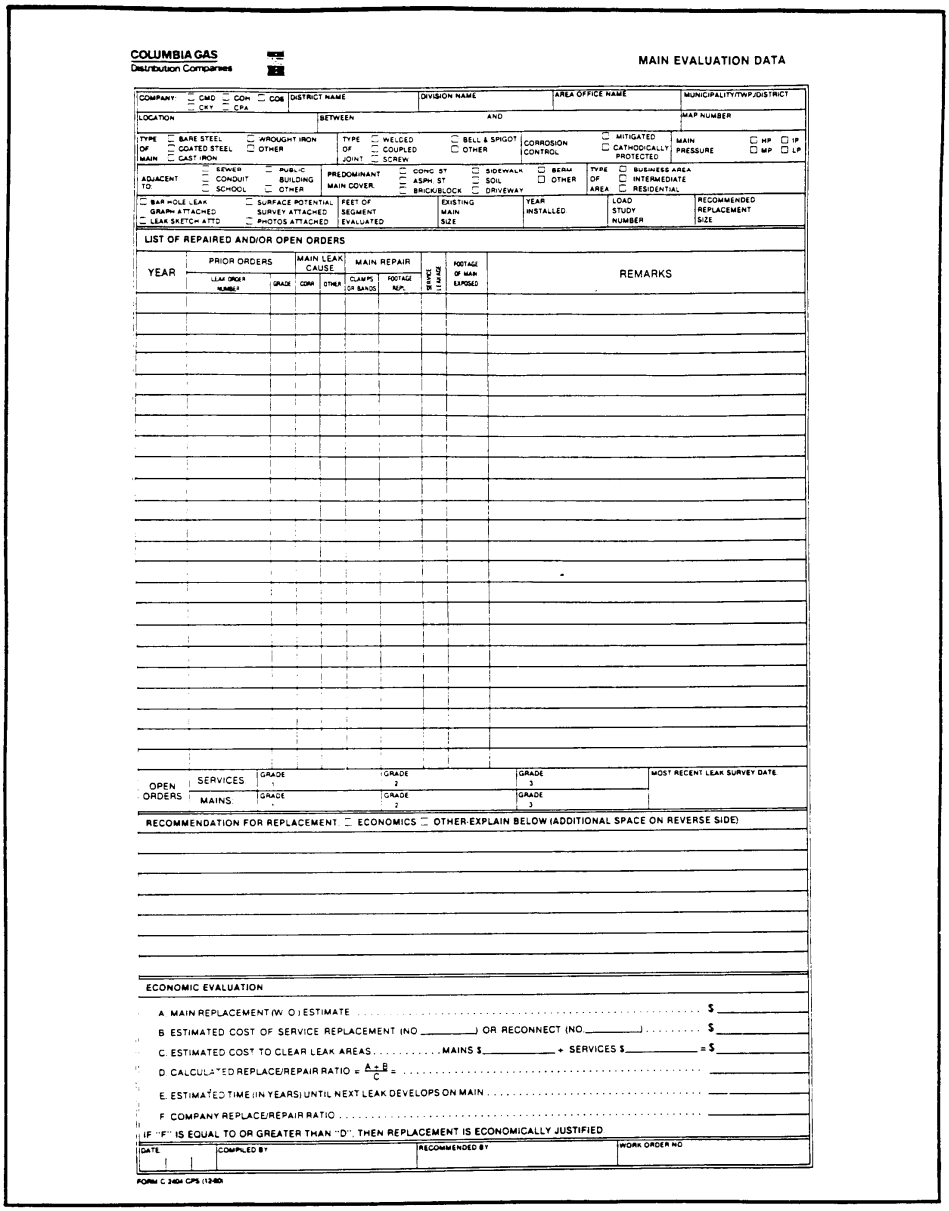
C. BLD.	G. LED.	AUX.	SUBSID.	OTHER

DISTRICT

DIVISION

AREA

EXHIBIT F



COLUMBIA GAS
Distribution Companies

MAIN EVALUATION DATA

COMPANY: ☐ CMD ☐ COH ☐ COE ☐ CKY ☐ CPA | DISTRICT NAME | DIVISION NAME | AREA OFFICE NAME | MUNICIPALITY/TWP/DISTRICT

LOCATION | BETWEEN | AND | MAP NUMBER

TYPE OF MAIN: ☐ BARE STEEL ☐ COATED STEEL ☐ CAST IRON ☐ WROUGHT IRON ☐ OTHER | TYPE OF JOINT: ☐ WELDED ☐ COUPLED ☐ SCREW ☐ BELL & SPIGOT ☐ OTHER | CORROSION CONTROL: ☐ MITIGATED ☐ CATHODICALLY PROTECTED | MAIN PRESSURE: ☐ HP ☐ IP ☐ MP ☐ LP

ADJACENT TO: ☐ SEWER ☐ CONDUIT ☐ SCHOOL ☐ PUBLIC ☐ BUILDING ☐ OTHER | PREDOMINANT MAIN COVER: ☐ CONC ST ☐ ASPH ST ☐ BRICK/BLOCK ☐ SIDEWALK ☐ SOIL ☐ DRIVEWAY ☐ BERM ☐ OTHER | TYPE OF AREA: ☐ BUSINESS AREA ☐ INTERMEDIATE ☐ RESIDENTIAL

☐ BAR HOLE LEAK GRAPH ATTACHED ☐ LEAK SKETCH ATTD | ☐ SURFACE POTENTIAL SURVEY ATTACHED ☐ PHOTOS ATTACHED | FEET OF SEGMENT EVALUATED | EXISTING MAIN SIZE | YEAR INSTALLED | LOAD STUDY NUMBER | RECOMMENDED REPLACEMENT SIZE

LIST OF REPAIRED AND/OR OPEN ORDERS

YEAR	PRIOR ORDERS: LEAK ORDER NUMBER	GRADE	MAIN LEAK CAUSE: CORR	OTHER	MAIN REPAIR: CLAMPS OR BANDS	FOOTAGE REPL.	WAIVER (LEAKAGE)	FOOTAGE OF MAIN EXPOSED	REMARKS

OPEN ORDERS: SERVICES — GRADE 1 | GRADE 2 | GRADE 3 | MOST RECENT LEAK SURVEY DATE
MAINS — GRADE 1 | GRADE 2 | GRADE 3

RECOMMENDATION FOR REPLACEMENT ☐ ECONOMICS ☐ OTHER-EXPLAIN BELOW (ADDITIONAL SPACE ON REVERSE SIDE)

ECONOMIC EVALUATION

A MAIN REPLACEMENT (W. O.) ESTIMATE ..... $ _____
B ESTIMATED COST OF SERVICE REPLACEMENT (NO _____) OR RECONNECT (NO _____) ..... $ _____
C ESTIMATED COST TO CLEAR LEAK AREAS ..... MAINS $_____ + SERVICES $_____ = $_____
D CALCULATED REPLACE/REPAIR RATIO = $\frac{A+B}{C}$ = ... _____
E ESTIMATED TIME (IN YEARS) UNTIL NEXT LEAK DEVELOPS ON MAIN ..... _____
F COMPANY REPLACE/REPAIR RATIO ..... _____
IF "F" IS EQUAL TO OR GREATER THAN "D", THEN REPLACEMENT IS ECONOMICALLY JUSTIFIED

DATE	COMPILED BY	RECOMMENDED BY	WORK ORDER NO

FORM C 2404 CPS (12-80)

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EXHIBIT G

STATION DESIGN MEMORANDUM

TO: S. G. Day DATE: August 21, 1990

FROM: R. A. Johnson

SUBJECT: Ford Motor Company
Lorain Assembly Plant

MS-7FF8125
Market No. 4775-2
Map No. 3632-0

STATION DESIGN DATA

	Regulation		Measurement
Inlet Pressure.....	90-135 psig	.....	90-135 psig
Outlet Pressure.....	20 psig	.....	90-135 psig
MCF/Max. Hour.....	440 Mcfh	.....	440 Mcfh
MCF/Min. Hour.....	90 Mcfh	.....	90 MCfh
Design Pressure.....	125 psig	.....	125 psig
Min. Test Pressure.....	188 psig	.....	188 psig
Min. Test Time.....	1 Hour	.....	1 Hour

Two Measurement Runs per Standard Drawing No. S-203, Topworks A

Meter Size	Manufacturer	Model No.	Working Pressure
6"	Rockwell	T-30 I.D.	175 psig

Regulation per Standard Drawing No. S-108, Topworks B, Setting D

Regulator Function	Size	Manufacturer	Type	Orifice	Spring	Set Pressure
Monitor	3"	Rockwell	441-57S	3" V-Port	Red 15-30 psig	23 psig
Control	3"	Rockwell	441-57S	3" V-Port	Red 15-30 psig	20 psig

STANDARD METER RECORDING GAUGE SPECIFICATIONS

Mercury Instrument Company 12" Pressure, Volume, Temperature, Time (PVTT) Recorder Model No. 1217 to be installed on 6" Turbine Meter with 100 Cu. Ft./Rev. of meter drive. Refer to Standard Drawing S-291 for Standard Meter Gauge Tube Fitting Kit (available from Bangs).

Pressure Range: 0-250 psig

100,000:1 Basic Gear Train with 1:1 Change Ratio; 10,000,000 Cu. Ft./Chart Revolution, based on Monthly Chart.

This is calculated on 70,000 Mcf/Mo. at 90 psig.

NOTES:
1. The capacity of the monitored regulation is 670 Mcfh with 90 psig in., 20 psig out.
2. The capacity of the meters total 426 Mcfh @ 90 psig.
3. Use Columbia universal chart no. 1004.

RAJ:clc
Attachment

cc: R. T. Burrows, R. J. Kuhner, R. A. Sutton, G. R. Cutler, H. F. Rauch, C. B. Jenkins, J. R. McKitrick, R. L. Butler

RAJ.001

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Gas Standard

Distribution Operations

Effective Date: 10/01/2011	**Capital and Related Job Order Completion Reports**	Standard Number: **GS 2810.020(CG)** P&P 623-7
Supersedes: 09/25/1992		Page 1 of 7

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL REQUIREMENTS

The completion of work provides an accurate accounting of material (Property Units) and detailed sketch of facilities location. This is accomplished by executing the Job Order in the Company's computer work management system (WMS) and by the submission of a Job Order Completion Report to update maps and accounting records.

These maps and records are used by Engineering, Finance (Asset Accounting, Tax, and Depreciation Sections) and Rate Departments, etc. A Job Order Completion Report is prepared in accordance with instructions found in Section 4 below.

A Job Order Completion Report shall be submitted through channels to Finance - Asset Accounting promptly after the project is executed in WMS, but no later than four months after the "Completed" date.

Engineering – C&T GIS (Maps & Records) shall administer the process of completing Job Orders, including Job Orders in-service four months and still in need of a Completion Report.

2. WORK ORDER AND/OR EXPENSE TRANSFER REQUEST

When charges are transferred between Job Orders or from a Job Order to expense, a Job Order transfer memorandum (see Exhibit A as an example) shall be completed and submitted to Finance - Asset Accounting.

The memorandum provides specific areas to add data, including an explanation of the transfer of charges and proper approvals. The memorandum should also include a copy of the invoice which was charged incorrectly and/or a copy of the applicable incorrect classifications as charged in WMS. Amounts under $100,000 shall be approved by the Engineering Manager and amounts $100,000 or more shall be approved by the Director of Field Engineering.

3. OPERATION MAPS

Hardcopy Operation Maps are not required to be kept in field locations. Engineering – C&T GIS (Mapping and Records) will maintain electronic information, and make it accessible to field locations.

At each location where hardcopy Operation Maps are chosen to be kept, they shall be verified against either the current GIS mapping data or a hardcopy set designated as the "Master Set." If using a Master Set, it shall be updated when each Job Order Completion Report is processed.

4. INSTRUCTIONS FOR SPECIAL TYPE COMPLETION REPORTS

4.1 Reimbursable Projects

Capital Job Order Completion reports for reimbursable jobs are marked as reimbursable within WMS.

4.2 Right-of-Way Job Orders

Job Orders used to secure rights-of-way can be completed when rights-of-way have been secured and after Engineering – C&T Survey and Land furnishes the information to Field Engineering.

The statement "Right-of-Way secured" shall be indicated in the WMS Job Order Execution Comments and the rights-of-way information shall be attached to the Completion Report.

4.3 Preliminary Survey and Investigation (PS&I) Job Orders (Job Type 2000)

When executing a PS&I Job Order in WMS, list the construction Job Order(s) and/or operation and maintenance accounts to be charged. Provide a percentage allocation for each account when more than one account is used. This will be shown on the Job Order Completion Report. A PS&I Job Order cannot be cancelled.

4.4 Maintenance and Jobbing Work in Progress (Job Type 0001)

On a Maintenance and Jobbing Job Order, list the construction job order(s) and/or operation and maintenance accounts to be charged. Provide a percentage allocation for each account when more than one account is used. A Maintenance and Jobbing Job Order cannot be cancelled.

The Completion Report for a damage claim Job Order shall reflect the claim number.

The Completion Report for an uprating Job Order shall be completed in accordance

with Section 4.10.

4.5 Site and Deed Job Orders

Upon receipt of a letter stating a deed or site has been acquired by C&T Survey and Land, a Job Order Completion Report shall be submitted and a copy of the letter shall be attached.

Under Execute Comments in WMS state “Site Secured,” and create a Facility in WMS to indicate the lease or deed number and related information.

4.6 Rectifier Job Orders

A Facility shall be created for each rectifier installed when executing the Job Order in WMS.

4.7 Building Job Orders

Upon notification that a building has been completed, the Job Order Completion Report will prompt the creation of a building Facility in WMS stating the size and indicating the type of material. Reference shall be made to the Land Facility on which the building was constructed. The building and regulator station as applicable number shall also be indicated.

4.8 Job Orders with Advanced Approval

When work is approved and completed prior to issuing a Job Order, it is permissible to submit and complete a Job Order by normal processes.

4.9 Insulating Fittings and Valve Installations

A WMS Capital Job Order shall be created to account for any pipe removed during the installation of an insulating fitting or new valve. For example, if a plastic insulating fitting requires the removal of eight feet or less of metallic pipe, list the amount of pipe removed. This will eliminate the need for a 108 - Retirement Job Order. This accounting treatment is an exception for insulating fittings and new valve installations only.

The sketch portion of WMS Capital Job Order shall reflect the existing main minus the portion removed, the footage of the pipe removed, and the appropriate map feature as shown in GS 2610.010(CG), “Map Features.”

4.10 Uprate Job Orders

A Job Order shall be completed when all actions required to uprate a facility are

accomplished. A copy of Form C-1445, "Uprate Certificate," shall be filed with the completed job order.

In addition, a map or sketch which clearly defines the piping uprated shall be provided to permit pressure indicator changes to the Operation Maps to be made.

The Operating Center shall maintain a copy of the Completion Report with Form 1660.020-1, "MAOP Worksheet," to which all related leakage, repair history, test data, etc. has also been attached. See GS 1660.020, "Maximum Allowable Operating Pressures (MAOP)."

5. COMPLETION SKETCH

5.1 General Instructions

The approved Job Order sketch may be used for the Job Order Completion Report sketch unless it does not accurately portray the "as built" installation. If a new sketch must be prepared, it shall be in accordance with instructions for preparation of the Work Order sketch contained in GS 2810.012(CG), "Work Order Preparation."

5.2 Specific Details

WMS Capital Job Order Completion Report sketch requirements:

a. Property Units installed shall be shown in red. Property Units retired shall be shown in green. Existing facilities shall be shown in black.

b. Material reflected in WMS shall balance with the material shown on the completion sketch, with the following exceptions:

   1. Material lost in construction due to cutting, hauling, welding, etc.

   2. Pipe used for non-Property Unit items, such as line markers, corner posts, protective posts, and vents need not be shown on the completion sketch.

   3. Pipe previously abandoned or retired from service and used for conduit pipe. The location, size and length shall be indicated on the sketch.

c. For approved mapping symbols used on Job Order Completion Report sketches refer to GS 2610.010(CG), "Map Features."

d. For regulator installations and retirements, an isometric sketch (Inventory Record Card Sketch can be used) shall be prepared, using the proper color codes. The sketch shall indicate the location of the regulator equipment, size of pipe, size and type (plug, gate, ball, etc.) of valves and other Property Units.

e. If tie-in measurements cannot be clearly indicated on the original sketch, a detail of the tie-in shall be drawn in the sketch area.

f. Where valves are installed in mains, the valve numbers assigned (prefixed by a "C" for a critical valve) shall be indicated on the Job Order Completion Report sketch. See GS 1760.010, “Critical Valve Inspection and Maintenance.”

g. The location of the installed pipe should be referenced, preferably from the road pavement center line. A property line reference may be used.

h. Corrosion control map features, as shown in GS 2610.010(CG), “Map Features” shall be used to show the location of test stations, points of insulation, and rectifiers when installed. The number of anodes installed and approximate spacing should appear on the Job Order Completion Report sketch, but will not be mapped.

i. When a mapped segment of existing main is separated by a tie-in, the sum of the segments should equal the quantity of the original segment as shown on the map, unless a map error is found. In the latter case, follow instructions in Section 5.2 j.

j. If any map feature, such as the size, length, or location of a pipe section, the size or location of a valve, or street name is found to be incorrect, note “Map Correction” on the Job Order Completion Report sketch and provide the correct information. If correction is extensive and extends over several maps, prepare Form 2610.040-1, “Map Revision/Fixed Capital Adjustment,” and submit in accordance with GS 2610.040, “Map Revisions.”

6. JOB ORDER OVER/UNDERRUNS

Capital Job Orders will be monitored for cost variance from the approved amount by WMS reports. Over/underruns will be processed according to the NGD Capital Allocation and Authorization Policy.

7. ATTACHMENTS

Documents needed to maintain accurate map, accounting and DIS records, as appropriate, shall be attached to the Job Order Completion Report when forwarded to the Finance - Asset Accounting Section. Engineering - C&T GIS shall screen all documents and ensure that documents needed for official Company records are attached prior to forwarding to Finance - Customer Accounting and/or Vital Records.

Examples of documents to be attached are: the original approved Job Order, Job Order Completion Report sketches, pertinent letters and/or agreements which explain any reimbursement arrangement, recording pressure gauge charts, subdivision plat maps, rights-of-way agreements, highway plans on all state reimbursable jobs, regulator station

isometric sketches, “Valve Location and Inspection Record,” “Uprate Certificate,” bill of sale on both purchase and sale Job Orders, letter to retire lease or deed, and any other written or typed papers containing information relative to the Job Order.

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Gas Standard

Distribution Operations

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Supersedes: 09/25/1992		Page 7 of 7

EXHIBIT A

Columbia Gas of Kentucky
A NiSource Company

Office Memorandum

To: Asset Accounting Manager Date:

Subject: Job Order and/or Expense Transfer Request

The amount indicated below was charged to the wrong Job Order and/or Expense Account as detailed on the attached printout. Please prepare a correction transferring the charges to the correct Job Order and/or Expense Account as shown.

Job Order and/or Expense Account as Charged:

CO	GEN	AUX	PROJ	ACTIV	FACIL	HCC	TCC	Amount

Job Order and/or Expense Account Which Should Have Been Charged:

CO	GEN	AUX	PROJ	ACTIV	FACIL	HCC	TCC	Amount

Explanation:

Prepared by

Approved by

Attachment(s)

MiSource

Gas Standard

Distribution Operations

Effective Date: 02/29/2016	**Hourly Rates and Accrual and Overhead Percentages Used in Calculating Cost**	Standard Number: **GS 2810.030**
Supersedes: 01/31/2016		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE None

Exhibit A lists the Hourly Rates and Accrual, and Overhead Percentages subject to regular periodic change. Other more permanent rates and percentages are included in the following procedures:

GS 6200.010(CG), GS 6200.010(MD), GS 6200.010(PA), or GS 6200.010(VA) “Charges for Customer Authorized Service.”

NiSource

Gas Standard

Distribution Operations

Effective Date: 02/29/2016	**Hourly Rates and Accrual and Overhead Percentages Used in Calculating Cost**	Standard Number: **GS 2810.030**
Supersedes: 01/31/2016		Page 2 of 2

Exhibit A	NiSource Gas Distribution Hourly Rates, Accruals, and Overhead Percentages				Revised Dated	3/23/2016 02/29/2016
	CKY	COH	CMD	CPA	CGV	CMA
Vacation and Non-Productive Time Accruals						
Vacation Accrual	8.860%	9.500%	9.360%	9.280%	9.320%	9.100%
Non-Productive Time	7.252%	7.351%	9.494%	7.799%	7.197%	9.172%
Total	16.112%	16.851%	18.854%	17.079%	16.517%	18.272%
Labor Overhead & Benefits						
Injuries & Damages	1.361%	1.889%	0.718%	0.856%	0.895%	1.917%
Group Insurance Plans	25.034%	22.975%	21.930%	19.558%	21.889%	18.673%
Thrift Plan	4.089%	4.532%	4.662%	4.548%	4.370%	4.814%
Retirement Income Plan	3.481%	1.020%	3.493%	-2.048%	4.050%	8.609%
Payroll Taxes						
Federal Insurance Contribution	6.854%	6.552%	7.128%	6.732%	6.822%	6.780%
Federal Unemployment Insurance	0.111%	0.366%	0.144%	0.145%	0.134%	0.121%
State Unemployment Insurance	0.641%	0.050%	0.261%	1.882%	0.418%	2.007%
Total	41.571%	37.384%	38.336%	31.673%	38.578%	42.921%
Construction Overheads						
Supervision & Engineering	24.400%	14.700%	16.400%	12.100%	17.400%	29.400%
General & Administrative	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Total	24.400%	14.700%	16.400%	12.100%	17.400%	29.400%
Allowance for Funds Used During Construction (AFUDC)						
Equity (419-1000-1)	5.313%	0.000%	0.000%	4.325%	4.102%	4.210%
Interest (432-1-1)	2.725%	0.731%	7.528%	2.222%	3.247%	1.680%
(Annual Rate) Total	8.038%	0.731%	7.528%	6.547%	7.349%	5.890%
15 Day Rate	0.335%	0.030%	0.314%	0.273%	0.306%	0.245%
30 Day Rate	0.670%	0.061%	0.627%	0.546%	0.612%	0.491%
Vehicle Rates						
Passenger Cars (All Classes)	$13.36	$15.90	$6.38	$11.85	$9.10	$17.80
Trucks (All Classes)	$6.75	$7.96	$7.99	$8.68	$8.12	$6.58
General Tool Rates						
Tractors/Trenchers	$24.93	$16.85	$16.51	$10.61	$6.09	$85.30
Field Operations Leader (FOL)						
Average Hourly Rate	$59.70	$59.70	$59.70	$59.70	$59.70	$68.86
Contributions/Reimbursements						
Income Tax factors	0.0000	0.0000	0.0000	0.0000	0.1713	0.0000
Milelage Rate for Company Car	$0.540	$0.540	$0.540	$0.540	$0.540	$0.540
Hourly Raw Labor Rate	$30.91	$31.33	$31.79	$32.07	$31.54	$34.12
Base Labor Rate	$35.89	$36.61	$37.78	$37.55	$36.75	$40.35
Hourly Labor Rate (Including Overheads)	$50.81	$50.30	$52.27	$49.44	$50.93	$57.67
Average Cost of Gas per MCF	$2.4910	$3.6800	$2.4350	$2.3354	$2.3697	$3.2790
Company Use - Per MCF	$3.8975	$3.4567	$3.2138	$4.0799	$5.5507	$5.0146
ITEMS CHANGED THIS MONTH ARE SHADED IN GREY	Approved by Segment Controller - Distribution					
					Linda Moore	

NiSource

Gas Standard

Distribution Operations

Effective Date: 05/01/2012	**Construction Reporting**	Standard Number: **GS 2810.040(CG)** P&P 627-6
Supersedes: 04/09/1996		Page 1 of 13

Companies Affected:

☐ NIPSCO	☐ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE KY - 807 KAR 5:0001 Section 9 and 5:022 Section 7(3)
OH - OAC Rule 4901:1-16-06
MD - COMAR Title 20, Sub Title 55, Chapter 03.02 J
PA - 52 PA Code Section 59:38

1. GENERAL

This procedure lists the state construction reporting requirements for CDC.

2. KENTUCKY

A report shall be filed with the Kentucky Public Service Commission (KPSC) at least thirty days prior to the construction or major replacement of any pipeline (including service lines) with a total estimated cost of $100,000 or more, or to be operated in excess of 100 psig.

Another report shall be filed as soon as possible after pressure testing with the KPSC to certify:

a. the maximum pressure to which the line is intended to be operated,

b. that the pipeline has been constructed and tested in accordance with 807 KAR 5:022, and

c. the results of the test.

Note: No pipeline shall be operated in excess of the pressure for which it is certified.

Reports mentioned above shall be filed directly by the District to the KPSC. A copy of the filed reports shall be forwarded to the Engineering Budget Administrator.

3. OHIO

The Ohio Public Utility Commission (PUCO) - Gas Safety Division requires notification of all proposed projects involving an expenditure of at least $200,000. These notifications must be filed as follows:

a. at least twenty-one days prior to the commencement of work

b. not later than seven days after commencement of construction

c. not later than one week after work has been completed

Reports to the PUCO - Gas Safety Division shall be submitted directly by the Districts on PUCO Form 217, Exhibit A, and a copy forwarded to the Engineering Budget Administrator.

In addition, the PUCO - Ohio Power Siting Board (OPSB) requires notification of steel distribution pipelines greater than 9 inches in diameter with a total estimated cost of $200,000 or more.

4. PENNSYLVANIA

The Pennsylvania Public Utility Commission requires notification of all proposed major construction, replacement or maintenance of plant at least thirty days prior to the commencement of work.

Major construction, replacement, or maintenance is defined as a single project involving an expenditure, in excess of $200,000. Exhibit B illustrates the construction notification format.

The Commission also requires notification of the completion date within one month of the in-service date.

Each District shall be responsible for filing the required notifications with the Pennsylvania Public Utility Commission. CPA's Operations Director and the Engineering Budget Administrator shall be provided a copy.

5. MARYLAND

The Maryland Public Service Commission requires written notification at least 10 days before the estimated start date of major construction projects involving:

a. new pressure regulating stations;

b. significant modifications to equipment at existing pressure regulating stations;

c. new or significant modifications of LNG or propane plants; and

d. new pipeline installations of 500 feet or more in length.

The written notification shall be submitted on the Maryland Public Service Commission form “Gas Pipeline Construction Notice,” Exhibit C. CMD's Operations Director and the Engineering - Vice President shall be provided a copy.

Effective Date: 05/01/2012	**Construction Reporting**	Standard Number: **GS 2810.040(CG)** P&P 627-6
Supersedes: 04/09/1996		Page 3 of 13

EXHIBIT A
(1 of 4)

Instructions for completion of PUCO Form 217, “Construction of Important Addition Report.”

The following items are keyed to PUCO Form 217, page 4 of this Exhibit.

Key	Item	Description
1	Operator	Use of Columbia Gas of Ohio.
2	1st Report 2nd Report 3rd Report	Check as appropriate. Note: Each report shall be submitted directly to the PUCO by the Districts with a copy furnished to Engineering - Plant Budgets as follows: a. The first report not later than twenty-one days before construction work will start; b. The second report not later than seven days after construction work has started; c. The third report not later than seven days after construction work has been completed.
3	Date of Report	Use date that 1st, 2nd, or 3rd report is mailed to PUCO.
4	Job No.	Use 4 digit Specific Budget No. or WMS J.O. No.
5	Construction Location	Provide a precise description of project location.
6	Proposed Dates: Starting Completion	Reflect on the “1st report” the project's anticipated starting and completion dates.
7	Actual Dates: Starting	Reflect on the “2nd report” the actual starting date.

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Supersedes: 04/09/1996		Page 4 of 13

EXHIBIT A
(2 of 4)

Key	Item	Description
8	Actual Dates: Completion	Reflect on the "3rd report" the actual completion date. This shall be the reported in-service date.
9	Class Location	Reflect Class Location 4 unless Engineering - Facilities Planning has authorized a different Class Location.
10	Replacement New Construction	Check as appropriate.
11	MAOP	Report the MAOP of the system.
12	Design Pressure of Weakest Element	Report the pressure which the Operations Engineer set as the maximum that shall be permitted or specified for the weakest component to be installed in the pipeline facility. This may be the pressure designated or desired to be reached at a future date.
13	Normal Operating Pressure	Report the pressure which the Operations Engineer set as the minimum that shall be permitted or specified for any component to be installed in the pipeline facility.
14	Size	Report all nominal steel and plastic pipe sizes of appreciable length. (See Key 16.)
15	Length	Report all appreciable pipe lengths. Appreciable is considered any length over 100 feet.
16	Wall Thickness	Report all actual wall thickness and/or SDR of pipe listed SDR under Key 14.
17	Grade Density	For steel pipe report the API 5L grade, such as Grade B, X42, X60, etc. For plastic pipe report the ASTM D2513 density specification, such as 2406/2708, 3406/3608/4710, etc.

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Distribution Operations

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EXHIBIT A
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Key	Item	Description
18	Anode Rectifier	If the project contains steel pipe, check whether the steel portion will be anoded or rectified.
19	Description of (Proposed) Work	Use description used in the "Job Summary" and “Job Description” blocks on the WMS Designed Capital Job Order.
20	Estimated Cost	Indicate the Total Specific Budget Estimate.
21	See Attached: Prints Cover Letter	Check and attach copy of Specific Budget Sketch. Normally indicate “N/A” (for cover letter)
22	Company Contact for More Info.	Reflect name of the contractor inspector's supervisor or the Operations Engineer in charge of the project.
23	Title	Reflect title of person named in Key 22.
24	Street Address	Use address of person named in Key 22.
25	Telephone	Use phone number of person named in Key 24.

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Supersedes: 04/09/1996		Page 6 of 13

EXHIBIT A
(4 of 4)

CONSTRUCTION OF IMPORTANT ADDITION REPORT

Operator (1) _____ (2) _____ 1st Report _____ 2nd Report _____ 3rd Report

Date of Report (3) _____ Job No. (4) _____

Construction Location (5) _____ (Street Address) _____ (City, Village or Township) _____ (County)

Proposed Dates: Starting (6) _____ Completion (6) _____

Actual Dates: Starting (7) _____ Completion (8) _____

Class Location (9) _____ Replacement (10) _____ or New Construction (10) _____

MAOP (11) psig Design Pressure of Weakest Element (12) psig Normal Operating Pressure (13) psig

	(14) Size	(15) Length	(16) Wall Thickness	(17) Grade	(18) Anode	(18) Rectifier
Steel						

			(16) SDR	(17) Density (M.D., H.D.)		
Plastic					//////	//////
					//////	//////
					//////	//////

Note: Please attach sheet if more space is needed.

Description of Project (19) _____

Estimated Cost (20) _____

See Attached: Prints (21) _____ Cover Letter (21) _____

Return to:

Chief, Gas Pipeline Safety Section
The Public Utilities Commission of Ohio
The Borden Building, 12th Floor
180 East Broad Street
Columbus, Ohio 43215-3793

Company Contact for More Info. (22) _____

Title (23) _____

Street Address (24) _____

City, State, Zip Code (24) _____

Telephone ( ) (25) _____

PUCO Form No. 217

Effective Date: 05/01/2012	Construction Reporting	Standard Number: GS 2810.040(CG) P&P 627-6
Supersedes: 04/09/1996		Page 7 of 13

EXHIBIT B
(1 of 4)

Instructions for completion of Pennsylvania Public Utility Commission's “Report of Major Construction Project.”

The following items are keyed to the “Report,” page 3 of this Exhibit.

Key	Item	Description
1	Company	Use Columbia Gas of Pennsylvania.
2	Department	Indicate District name.
3	Estimated Cost of Project	Indicate the Total Specific Budget Estimate.
4	Description of Project	Use description used in the “Job Summary” and “Job Description” blocks on the WMS Designed Capital Job Order.
5	Location of Project	Provide a precise description of project's location.
6	Estimated Starting Date	Reflect project's anticipated starting date.
7	Estimated Completion Date	Reflect project's anticipated completion date.
8	Person to be Contacted	Reflect name of the contractor inspector's supervisor or the Operations Engineer in charge of the project.
9	Address	Use address of person named in Key 8.
10	Telephone No.	Use phone number of person named in Key 8.
11	Maximum Allowable Operating Pressure	Report the MAOP established on Form C 2134, “MAOP Worksheet,” for the system.

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Gas Standard

Distribution Operations

Effective Date: 05/01/2012	**Construction Reporting**	Standard Number: **GS 2810.040(CG)** P&P 627-6
Supersedes: 04/09/1996		Page 8 of 13

EXHIBIT B
(2 of 4)

Key	Item	Description
12	Construction Type	Indicate whether project is primarily a new, replacement or betterment project.
13	Location Class	Reflect Class Location 4 unless Engineering - Facilities Planning has authorized a different Class Location.
14	Pipe and Coating Description	
14a	Nominal Diameter	Self-explanatory.
14b	Nominal Wall Thickness	Self-explanatory.
14c	Pipe Specification	Indicate for steel pipe API 5L, and for plastic pipe ASTM D2513.
14d	Grade	Indicate for steel pipe Grade B, X42, X60, etc. and for plastic pipe 2406/2707, 3406/3608/4710, etc.
14e	Type	Indicate whether steel, plastic or steel and plastic as appropriate.
14f	Coating Type	For steel pipe, indicate type coating, such as epoxy, coal tar wrap, X-Thru, etc. For plastic pipe indicate N/A.
14g	Method of Application	Indicate “factory applied.”
15	Test Data	Indicate test medium and duration required by GS 1500.010 and GS 1500.010(OH) “Pressure Testing.”

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Distribution Operations

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Supersedes: 04/09/1996		Page 9 of 13

EXHIBIT B
(3 of 4)

REPORT OF MAJOR CONSTRUCTION PROJECT

COMPANY _____(1)_____ DEPARTMENT ___(2)

ESTIMATED COST OF PROJECT _____(3)

DESCRIPTION OF PROJECT _____(4)

LOCATION OF PROJECT _____(5)

ESTIMATED STARTING DATE _____(6)

ESTIMATED COMPLETION DATE _____(7)

PERSON TO BE CONTACTED REGARDING PROJECT ___(8)

ADDRESS _____(9)

_____ TELEPHONE NO. ___(10)

MAXIMUM ALLOWABLE OPERATING PRESSURE _____(11)

CONSTRUCTION TYPE _____(12)_____ LOCATION CLASS ___(13)

PIPE & COATING DESCRIPTION: (14)

a. Nominal Diameter ___(14a)___ b. Nominal Wall Thickness (14b)

c. Pipe Specification ___(14c)___ d. Grade (14d) e. Type (14e)

f. Coating Type _____(14f)___ g. Method of Application (14g)

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Distribution Operations

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EXHIBIT B
(4 of 4)

TEST DATA: (15)

a. Test Medium _____ b. Duration

Submit to:

Gas Safety Division, Bureau of Safety and Compliance
Pennsylvania Public Utility Commission
Post Office Box 3265
Harrisburg, Pennsylvania 17120

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Distribution Operations

Effective Date: 05/01/2012	**Construction Reporting**	Standard Number: **GS 2810.040(CG)** P&P 627-6
Supersedes: 04/09/1996		Page 11 of 13

EXHIBIT C
(1 of 3)

Instructions for completion of Maryland PSC form “Gas Pipeline Construction Notice.”

The following items are keyed to Maryland PSC form “Gas Pipeline Construction Notice.”

Key	Item	Description
1	Operator	Use Columbia Gas of Maryland.
2	Date	Use date that report is mailed to Maryland PSC.
3	Estimated Start Date	Reflect the project's anticipated starting date.
4	Estimated Completion Date	Reflect the project's anticipated completion date.
5	Construction Location	Provide a precise description of project location.
6	Contractor	Provide name of contractor performing work or indicate “N/A.”
7	Type of Construction	Check all applicable boxes.
8A	Material Type Steel Proposed MAOP	Report the MAOP of the system, if applicable.
8B	Material Type Plastic Proposed MAOP	Report the MAOP of the system, if applicable.
9	Length	Report all steel and plastic pipe lengths.
10	Pipe Diameter	Report all nominal steel and plastic pipe diameters.
11	Wall Thickness	Report all actual wall thickness and/or SDR of pipe SDR listed under Key 10.

EXHIBIT C
(2 of 3)

12	Pipe Grade	For steel pipe report the API 5L grade, such as Grade B, X42, X60, etc.
	Density	For plastic pipe report the ASTM D 2513 density specifications, such as 2406/2708, 3406/3608/4710, etc.
13	Manufacturer	For plastic pipe, report the pipe manufacturer.
14	Description of Project	Use the description used in the “Job Summary” and “Job Description” blocks on the WMS Designed Capital Job Order.
15	Submitted By	Reflect name of the contractor inspector's supervisor or the Operations Engineer in charge of the project.
16	Phone Number	Use the phone number of the person in Key 15.

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Distribution Operations

Effective Date: 05/01/2012	**Construction Reporting**	Standard Number: **GS 2810.040(CG)** P&P 627-6
Supersedes: 04/09/1996		Page 13 of 13

EXHIBIT C
(3 of 3)

GAS PIPELINE CONSTRUCTION NOTICE

COMPLETE AND RETURN THIS NOTICE TO THE ADDRESS BELOW 10 DAYS PRIOR TO THE START OF MAJOR CONSTRUCTION PROJECTS: SEE COMAR 20.55.03.02J

Operator (1) Date (2)

Estimated Start Date (3) Estimated Completion Date (4)

Construction Location: (5) County _____

City _____ Street _____

Contractor (6)

TYPE OF CONSTRUCTION (7)

- ☐ New Regulator Station
- ☐ Modifications to existing Regulator Station
- ☐ New Gas Plant
- ☐ Modification to existing Gas Plant
- ☐ New Pipeline Construction (complete sections for steel and/or plastic)

MATERIAL TYPE - STEEL **Proposed MAOP** (8A)

Length (9) Pipe Diam (10) Wall Thck (11) Pipe Grade (12)

Length _____ Pipe Diam _____ Wall Thck _____ Pipe Grade _____

MATERIAL TYPE - PLASTIC **Proposed MAOP** (8B)

Length (9) Pipe Diam (10) SDR (11) Density (12) Manufacturer (13)

Length _____ Pipe Diam ____ SDR ____ Density _____ Manufacturer _____

DESCRIPTION OF PROJECT

(14)

_____

_____

_____

_____

_____

SUBMIT TO:

Maryland Public Service Commission
Engineering Division 19th Floor
6 St Paul Centre
Baltimore, MD 21202-6806
FAX: (410) 333-6086

SUBMITTED BY: (15)

Phone Number (____) (16)

EN39 Revised 7/18/94

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Distribution Operations

Effective Date: 06/25/1990	**Construction Budget Variance**	Standard Number: **GS 2830.094(CG)** P&P 627-5
Supersedes: N/A		Page 1 of 6

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

Occasionally it may be necessary to request a variation to a Blanket budget that is part of an approved Capital Construction and Retirement Program or to a Specific Budget that has been approved. Such a request should be submitted on a form entitled “Notification of Construction Budget Variation,” Exhibit A (on CMS on-line file), which is available from the Engineering - Budgets and Statistics Section.

This form serves a two-fold purpose in that it may be used for either a Blanket or Specific budget variation request. For Blanket Budget(s) the approved Notification Variation is sufficient approval to proceed with the expenditure(s) and incur cost variation(s) to the budget as outlined in the request. For Specific Budgets the Notification Variation is an alert for management, but does not constitute full approval to incur costs until a revised budget has been processed and approved.

Approval shall be requested and secured prior to incurring costs exceeding budget level, except where public safety is a factor or where we would experience additional costs due to delay or default on commitments. The Vice President - Engineering must be advised verbally when changes in scope of a project or other factors dictate a change to any budgeted amounts so significant as to require the submission of a request. This should be done prior to the official budget variation request, so that alternatives may be discussed. Telephone notification to the Vice President - Engineering to have a general discussion of any proposed changes in scope on a Specific Budget is required regardless of whether the change in scope affects the budgeted amounts.

2. PREPARATION

Once the file containing the screen has been acquired, completion is accomplished using the CMS XEDIT sub-system and the instructions contained in Exhibit A.

Effective Date: 06/25/1990	Construction Budget Variance	Standard Number: GS 2830.094(CG) P&P 627-5
Supersedes: N/A		Page 2 of 6

3. DISTRIBUTION

Upon completion of the CMS file screen, hard copies will be printed for distribution. One copy will be circulated for District and Company approval signatures and the others distributed for information purposes as indicated on the CMS file screen.

A copy of the CMS file screen shall be transmitted to the CMS reader of the Engineering - Budgets and Statistics Coordinator.

4. APPROVALS

Approval signatures of the District Plant/Service Manager [Director of Plant/Service Operations (COS)] and the District Manager [Vice President of Operations (COS)] shall be secured and forwarded to the appropriate Company President. The Company President will review and approve/disapprove, as appropriate, and then forward to the Vice President - Engineering. The Vice President - Engineering will furnish the approved copy to the Budgets and Statistics Section for final action.

5. BUDGETS AND STATISTICS SECTION

Since the Budget and Statistics Section should already be aware of a possible change in the budget, it will await the approval or disapproval of the request. The submitting location will be notified in either case and, if the variation is approved, should reflect the change in its current status and retain a signed copy in its files. Approved copies of all Specific Budget notifications shall be forwarded to Finance-Construction Budget Section, for inclusion in the next CDC Budget Advisory Committee Meeting.

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Gas Standard

Distribution Operations

Effective Date: 06/25/1990	**Construction Budget Variance**	Standard Number: **GS 2830.094(CG)** P&P 627-5
Supersedes: N/A		Page 3 of 6

EXHIBIT A
(1 of 3)

Instruction for completing the data needed for the Notification of Construction Budget Variation file.

KEY	ITEM	DESCRIPTION
1	"Company Name"	Verify Company Name.
2	"Specific or Blanket Budget - Over/Underrun"	Indicate with an "X" if this notification is for a Specific overrun or underrun or Blanket(s) overrun or underrun or both.
3	To:	Normally addressed to the District Manager/Vice President - Operations (COS).
4	From:	Normally sent by the District Plant/Service Manager or Director of Plant/Service Operation (COS).
5	Date	Self explanatory.
6	Budget No.:	Enter a single Specific Budget number or a single or multiple Blanket Budget No(s). Note: The reason for entering multiple Blankets must be explained in Key 16.
7	Title:	Enter appropriate budget title(s).
8	Date App'd	For a Specific Budget enter approval date. For a Blanket Budget(s) enter date(s) of program approval.
9	Amount App'd. - $	Enter amount(s) previously approved.
10	Current Est. - $	Enter current estimate(s).
11	Variation - $	Enter different between amount approved (Key 9) and current estimate (Key 10).

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Distribution Operations

Effective Date: 06/25/1990	**Construction Budget Variance**	Standard Number: **GS 2830.094(CG)** P&P 627-5
Supersedes: N/A		Page 4 of 6

EXHIBIT A
(2 of 3)

KEY	ITEM	DESCRIPTION
12	Variation - %	Compute and enter variation percentage from amount approved (Key 9).
13	Expenditures to Date - $	Enter total expenditures to date.
14	Date Work Started	Indicate starting date if a Specific Budget.
15	Date Work Finished	Indicate date work was or will be finished if a Specific Budget.
16	Explanation of Variations:	Provide a complete explanation for the variation. Each listed blanket budget (Key 6) variation shall be explained in detail. Note: Exhibit B is a rider which can be used to continue the explanation.
17	"Previous Submission"	"X" the yes or no as appropriate.
18	Copies:	Indicate distribution. Copies shall be distributed to: Company President Engineering - Vice President Finance - Controller Director Plant/Service Operations Director Facilities Planning Engineering - Plant Budget Supervisor Engineering - Statistics Coordinator
19	Approvals	Self-explanatory.

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Effective Date: 06/25/1990	**Construction Budget Variance**	Standard Number: **GS 2830.094(CG)** P&P 627-5
Supersedes: N/A		Page 5 of 6

EXHIBIT A
(3 of 3)

(1) Company

NOTIFICATION OF CONSTRUCTION BUDGET VARIATION

Specific Budget
2 Overrun
Underrun

(2) Blanket Budget
Overrun
Underrun

To: (3)	From: (4)	Date: (5)

Budget No. (6)	Title: (7)

Date App'd. (8)	Amount App'd.-$ (9)	Current Est.-$ (10)	Variation-$ (11)	Variation-% (12)

Expenditures to Date - $ (13)	Date Work Started (14)	Date Work Finished (15)

Explanation of Variation:

(16)

Is this the first memo submitted on this budget?
YES (17) NO

If No, Attach Copy of Prior Memo(s)

COPIES:

(18)

(19) APPROVALS

District Plant/Service Manager or Director of Plant/Service Oper. (COS)

District Manager or Vice-President-Operations (COS)

VP - Engineering

President

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Effective Date: 06/25/1990	**Construction Budget Variance**	Standard Number: **GS 2830.094(CG)** P&P 627-5
Supersedes: N/A		Page 6 of 6

EXHIBIT B

Columbia Gas of Ohio, Inc.

NOTIFICATION OF CONSTRUCTION BUDGET VARIATION

Page 2

Budget No.	Title:

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Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supersedes: N/A		Page 1 of 31

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

Investigations of gas facilities, both in private and public rights-of-way, necessitated by a governmental agency construction, such as a roadway, sewer, bridge, stormline, waterline, etc. shall follow a process that assures:

a. Cooperation with governmental agencies
b. Minimum relocation of facilities
c. facility protection
d. continuing operations if required
e. reimbursement if appropriate
f. coordination between all parties involved, other utilities, landowners, etc.

Each Columbia Gas Distribution Company deals with many governmental agencies with varying requirements which may differ from this procedure. The variations shall be resolved by each District.

2. AID-IN-CONSTRUCTION TAX

Federal tax law requires that any reimbursement for the relocation of facilities of a utility be considered aid-in-construction and be subject to taxation if such reimbursement was made as a prerequisite to or as an inducement to the providing of gas service by the utility. Questions on taxability should be directed to Finance - Director of Taxes and Risk Management.

The reimbursement shall be classified as taxable or nontaxable. The taxable status shall be indicated on Form C 2695, “Journal Voucher Sub,” Exhibit I so that Finance - Asset Accounting Section can classify the reimbursement correctly. The taxable status shall be indicated whether or not a gross up, as indicated in the next paragraph, to recover the tax from the customer is required.

Only in Commonwealth of Virginia, where the cost of the tax is not currently recovered through rate base, shall the reimbursement be grossed up to recover the cost of the tax from the customer. The amount of the gross up is calculated by multiplying the Total Estimate by an Income Tax Factor obtained from GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculation Costs." The tax collected is classified to account 421-0104 but is not reflected in the Work Order estimate.

3. RESPONSIBILITIES

3.1 District

Each District is responsible for:

a. verification of gas facilities locations

b. marking the location of gas facilities on public work plans in the field

c. budgeting, design, and construction of all relocated gas facilities

d. issuing construction and retirement work orders

e. insuring charges to Work Order are appropriate and complete

f. billing for and monitoring reimbursement

3.2 Civil Engineering

When requested on Form C-1434, "Request for Service," Exhibit A, Engineering - Civil Engineering is responsible for:

a. confirming or securing land rights

b. cooperating with Districts on field location investigations

c. graphic representation and/or marking plans

d. providing necessary land surveys

3.3 Asset Accounting

Finance - Asset Accounting Section is responsible for:

a. furnishing detail billing information to each District when requested

b. publishing reminder notices to ensure billing has been made

Note: Districts may request detail billing information directly from EDP - Operations by use of Form CS 1-516, “Search Control for Preliminary Listing,” Exhibit B.

3.4 General Accounting

Finance - General Accounting is responsible for publishing accounts receivable reports.

3.5 Credit/Collections

Finance - Credit/Collections Section is responsible for taking appropriate action to collect amounts receivable.

4. PRELIMINARY NOTICE AND UTILITY PLANS

4.1 Preliminary Notice

The Districts will normally receive the preliminary notice and utility plans (schematic, preliminary, or centerline) covering a proposed project from the applicable governmental entity or its consulting firm.

4.2 Marking and Verification of Company Facilities

The District shall review the Preliminary Plan and supply the level of detail necessary to assure that the Company's interests are protected. The District may mark the utility plans from the “Master Set” of operation maps, supply updated operation maps to provide the general location or provide actual field locates.

The Operations Engineering shall review the utility plan, prepare a transmittal letter (Exhibit C), return the utility plan and request a detail plan.

Every effort shall be made to convey to the government agency or consultant any potential facility conflicts so that corrective design changes can be made. Therefore, the transmittal letter shall include, as a minimum, the following type statement.

"These plans (or operation maps) reflect only the approximate location of our facilities as they exist today. Changes in location may occur in the future and may differ from locations indicated on current records.

Please contact_____at least ten days before you perform field surveys. We will endeavor to locate our facilities so that they may be included on your detailed plans.

We would appreciate an opportunity to review all potential conflicts with you during the design phase to eliminate or minimize construction conflicts.

5. REVIEW OF DETAILED PLANS

Upon receiving the detail plans the Operations Engineer or, if requested, Civil Engineering shall compare the plans with “Master Set” of operation maps, identifying those facilities located within the proposed project limits.

If a project is deemed reimbursable, the district shall obtain written authorization from the governmental agency prior to charging to a reimbursement PS&I Work Order. Failure to acquire authorization could result in disallowance of reimbursement.

When in doubt whether the location of existing facilities affected by the improvement qualifies for reimbursement, contact the Land Section by submitting Form C-1434. At this point it may be beneficial for the District and the Land Section to meet and discuss the project which may be located both on private and public rights-of-way.

5.1 Preliminary Survey and Investigation Work Orders (P.S. &I.)

The District shall issue PS&I Work Orders to cover the affected facilities as required by GS 2810.010(CG) “Initiating an Individual Work Order.”

5.2 Investigation, Survey, and Design of Facilities

The location and elevation, if needed, of the existing facilities relative to the centerline and right-of-way limits of the existing and proposed project shall be determined and indicated on the detailed plans.

The District may request Civil Engineering to provide engineering and survey assistance by submitted Form C-1434.

6. DESIGN OF FACILITIES

The Operations Engineer responsible for the project shall review the detailed plans indicating existing and proposed facilities. The design, location and need of proposed facilities shall be discussed with Engineering - Facilities Planning, Land Section, Civil Engineering Section and/or Local operating personnel, as appropriate.

The Operations Engineer and/or Civil Engineering shall then meet with the governmental representative to recommend revisions to the plans that would eliminate conflicts with Company facilities.

The proposed rearrangement of gas facilities is drawn on the detail plans. At this time, if more than 30 days have elapsed since the initial review of the detail plans, a second comparison of the plans will be made with the "Master Set" of operation maps and Work Center Register before the final plans are distributed.

7. BIDS FOR REIMBURSEMENT PROJECTS

When reimbursement work is to be performed by contract(s), the District shall solicit bids for the proposed remedial work from at least three (3) contractors. Refer to applicable Supply Chain procedures.

Blanket contracts may be used in lieu of separate bid sheets but the blanket contract shall be submitted to the appropriate governmental agency with justification for its use over separate bid sheets.

8. SUBMISSION OF FINAL PLANS

If the project involves no reimbursement, the District shall prepare a transmittal letter (Exhibit D) and highway permit application (where required) and submit with the required number of final plans to the government agency.

On a reimbursable project the district shall prepare a preliminary estimate (based on a Work Order estimate) and transmittal letters Exhibit E. Copies, when required, of contractor completed bid sheets, Form C-1487, "Spread Sheet," along with the required number of final plans, shall be included with the transmittal letter when submitted to the governmental agency for approval.

9. STATE HIGHWAY STATUS REPORTS

The various State highway departments prepare and/or distribute a utility status report on most jobs prior to the bid letting. The project Operations Engineer, provides information and/or reviews the content of the utility status report and compare it with the proposed construction. If differences are noted, the highway department shall be notified.

10. CONSTRUCTION AND RETIREMENT WORK ORDERS

The District shall issue all necessary construction and retirement Work Orders. Budget approval of the construction monies is a prerequisite to the issuance of construction Work

Orders.

Upon approval of the Work Orders, the PS&I.Work Order may be closed and accumulated charges transferred to the appropriate construction Work Orders. The decision to close the P.S.&I. Work Order should be based on billing arrangements that are appropriate to the billed authority.

The P.S.&I. Work Order number shall be listed on the construction Work Order in the space for related Work Order Numbers. In addition boxes requesting permits and special services shall be checked as appropriate.

11. PROJECT AUTHORIZATION AND COMMENCEMENT OF CONSTRUCTION

After the governmental agency approves the plans, estimates, bids, work schedule, and proposed work the District will receive an approval letter. Upon receipt of the approval letter the District shall confirm that all permits and special services have been acquired.

The District should request Civil Engineering or a District Survey crew to set stakes, when required, for construction. Provide at least one week's advance notice per staking.

Three (3) days prior to beginning construction the District shall notify:

a. the government agency and
b. the “one call system,” or other effected utilities

NOTE: Do not deviate from the approved plans unless written permission is obtained from the authorized governmental agency official on Form C-1783, “Change Order Authorization” (Exhibit F). This written permission is required to document Company records when construction is not in accordance with the approved plan.

Salvaged materials removed from the existing reimbursable facility are to be stored for inspection by the governmental agency inspector prior to any reconditioning of the salvaged material. This will ensure that the proper salvage credit will be applied in the final billing to the governmental agency. The District shall notify the authorized inspector by letter, as to:

a. location of the salvage material
b. time and ate the material can be inspected
c. name of the Company representative who will show the material

12. COMPLETION OF PROJECT AND FINAL BILLING

The District shall:

a. request Civil Engineering or District Engineering to have “as-built” drawings prepared, if required

b. expedite the billing process.

Upon request, Asset Accounting can furnish the District with the partial or final billing detail, Exhibit G or the District can request the information directly from EDP-Operation by Form CS 1-516, “Search Controls for Preliminary Listing.” Exhibit B.

Asset Accounting will publish monthly notices after the project has been reported in service for six (6) months and with no final bill (Exhibit H). Notification will continue until A form c 2696, “Journal Voucher Sub,” Exhibit I, has been received indicating a final bill.

The District shall review the partial or final billing detail and prepare an invoice Exhibit J on the appropriate “Invoice” form. (Form C-7-1A, “Invoice” for Columbia Gas of Ohio, Inc., or Form C-7-1, “Invoice” for other Columbia Gas Distribution Companies, Exhibit K).

“Remit Payment To” address on the Invoice shall not be changed to reflect the District Office address. Invoice numbers shall consist of three (3) parts. The first part shall be the designation “LS.” The second part shall be the District designation, i.e. 1300 for Central District, 2100 for Binghamton District, etc. The third part shall be a sequential identification number from 1 to 99 controlled by the District. The remaining portions of the Invoice shall be completed with available information.

The District shall then forward the original and two (2) copies of the Invoice to the governmental agency along with the billing detail and any other explanation. The District shall retain a copy. The remaining two (2) copies (one being the pre-punch copy) shall be forwarded along with Form C-2695 “Journal Voucher Sub,” Exhibit I, to Finance - Asset Accounting Section.

13. REIMBURSEMENT ACCOUNTING

Form C-7-1 or C-7-1A, “Invoice,” Exhibit K, when submitted for billing shall not have the “Remit Payment To” address altered. Payment shall be remitted directly to Finance - Cash Management Section to assure correct posting credit.

If a reimbursement payment is received by the District, it shall be deposited locally to Account 143-9-2 (District Number) and be reflected on the Daily Cash Report, Exhibit L. The District shall also send the “Invoice” stubs to Finance-Accounts Receivable to assure

the reconciliation of Account 143-9-2.

General Accounting will publish a monthly report of Accounts Receivable that reflects the status of invoices against accounts that have not been paid, Exhibit M and distribute to:

a. Company Presidents
b. Engineering - Vice President
c. District Managers [(Vice President of Operations (COS)]
d. Finance - Credit/Collection Section

If payment in full is not received within 90 days of billing Finance - Credit/Collection Section shall, after consultation with the District, take appropriate action. Asset Accounting Section and the District Manager [Vice President of Operations (COS)] shall be advised in writing of any uncollectible amount by the Credit/Collections Section. Asset Accounting will then make the appropriate journal entry, attach the explanation and forward to reverse the uncollectible amount.

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 9 of 31

EXHIBIT A

FORM C 1434 CSD (5-85)

JOB NO. _____ (C.E.,G. & L. ONLY)

REQUEST FOR SERVICE
TO CIVIL ENGINEERING, GRAPHIC AND/OR LAND SECTION

DATE ISSUED _____

MAP NO. _____

STATE	CO. BILLED	GEN. LEDGER	BUDGET	LOCATION	WORK ORDER NO.	C.E.

COMPANY _____ DEPT. _____ DIST. _____ DIV. _____ AREA _____

SURVEY _____ RAILROAD CROSSING PERMIT _____

EASEMENT OR R/W _____ STREAM CROSSING PERMIT _____

HIGHWAY PERMIT _____ OTHER _____ (DESCRIPTION)

ACQUIRE SITE _____ EXISTING AGREEMENT NUMBER _____

PROJECT LOCATION _____

PROJECT DESCRIPTION _____

CONSTRUCTION WILL START _____

FOR PROJECT DETAILS CONTACT: _____ AT _____ (LOCATION)

REQUESTED BY _____

REMARKS _____

NOTE: ATTACH WORK ORDER COPY OR SKETCH

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
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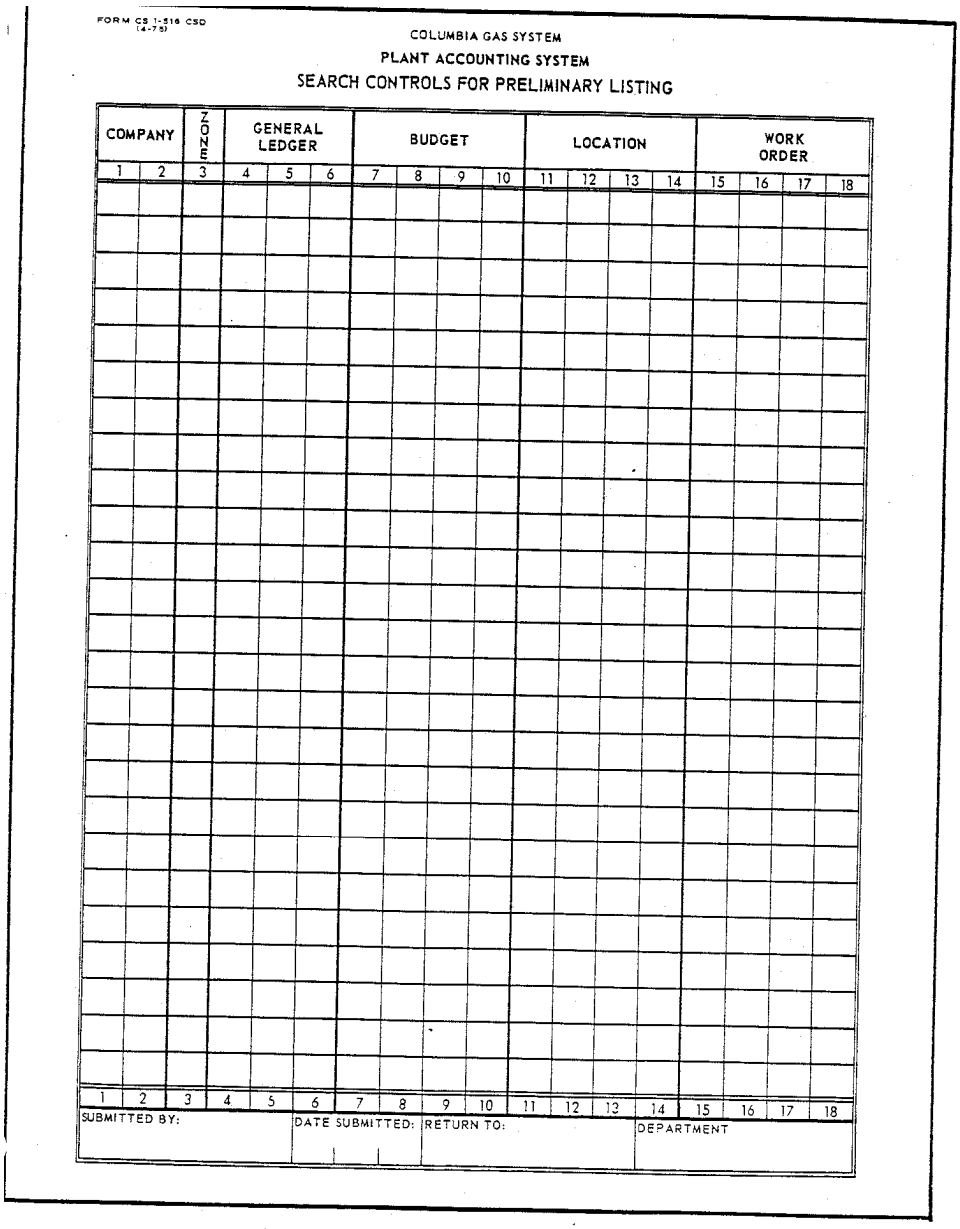
EXHIBIT B



FORM CS 1-516 CSO 14-75)

COLUMBIA GAS SYSTEM

PLANT ACCOUNTING SYSTEM

SEARCH CONTROLS FOR PRELIMINARY LISTING

COMPANY		ZONE	GENERAL LEDGER			BUDGET				LOCATION				WORK ORDER			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

SUBMITTED BY: | DATE SUBMITTED: | RETURN TO: | DEPARTMENT

MiSource

Gas Standard

Distribution Operations

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Supercedes: N/A		Page 11 of 31

EXHIBIT C
(1 of 2)

COLUMBIA GAS
Distribution Companies

Columbia Gas of Kentucky
Columbia Gas of Maryland
Columbia Gas of New York
Columbia Gas of Ohio
Columbia Gas of Pennsylvania
Commonwealth Gas Services

Date _____

Consultant Engineer
Address
City, State Zip Code

RE: Project Name

Dear _____:

Returned is one (1) set of your preliminary plans on which we have indicated from office records where Columbia Gas of _____ has gas facilities within the limits of the proposed project.

These plans reflect only the approximate location of our facilities as they exist today. Changes in location may occur in the future and may differ from locations indicated on current records.

Please contact _____ at least ten working days before you perform field surveys. We will endeavor to locate our facilities so that they may be included on your detailed plans.

*This procedure will comply with Section 153.64 ORC as stated in O.D.O.T. letter of Bernard B. Hurst, P.E., Assistant Director dated July 7, 1983.

We would appreciate an opportunity to review all potential conflicts with you during the design phase to eliminate or minimize construction conflicts."

Sincerely,

Name
Title

XXX:xxx

Enclosures

*Incorporate into COH letters only.

Columbia Gas Distribution Companies, 200 Civic Center Drive, P.O. Box 117, Columbus, Ohio 43216-0117

EXHIBIT C
(2 of 2)

COLUMBIA GAS
Distribution Companies

Columbia Gas of Kentucky
Columbia Gas of Maryland
Columbia Gas of New York
Columbia Gas of Ohio
Columbia Gas of Pennsylvania
Commonwealth Gas Services

January 2, 1985

Department of Transportation
Address
City, State Zip Code

Attention: Name
Title

RE: Project Name

Dear _____:

Enclosed are copies of Columbia Gas of _____, Inc.'s operations maps showing facilities which may be affected.

These operation maps reflect only the approximate location of our facilities as they exist today. Changes in location may occur in the future and may differ from locations indicated on current records.

Please contact _____ at least ten working days before you perform field surveys. We will endeavor to locate our facilities so that they may be included on your detailed plans.

*This procedure will comply with Section 153.64 ORC as stated in O.D.O.T. letter of Bernard B. Hurst, P.E., Assistant Director dated July 7, 1983.

We would appreciate an opportunity to review all potential conflicts with your during the design phase to eliminate or minimize construction conflicts."

Very truly yours,

Name
Title

XXX:xxx

Enclosures

*Incorporate into COH letters only.

Columbia Gas Distribution Companies, 200 Civic Center Drive, P.O. Box 117, Columbus, Ohio 43216-0117

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Gas Standard

Distribution Operations

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EXHIBIT D

COLUMBIA GAS
Distribution Companies

Columbia Gas of Kentucky
Columbia Gas of Maryland
Columbia Gas of New York
Columbia Gas of Ohio
Columbia Gas of Pennsylvania
Commonwealth Gas Services

Date

County Engineer's Office
Address
City, State Zip Code

Attention:

RE: Project Name

Gentlemen:

We have enclosed, in septuple, plans showing the proposed remedial work to be performed on the Columbia Gas of _____, Inc.'s facilities necessitated by the proposed improvement of (Project Name), in (Township), (City), (State).

This remedial work will be performed at our Company's expense due to the existing affected facilities being located within existing public right of way.

Please process the enclosed plans for approval so that we may be authorized to proceed with the proposed remedial work.

Very truly yours,

Name
Title

XXX:xxx

Enclosure - Plans

Columbia Gas Distribution Companies, 200 Civic Center Drive, P.O. Box 117, Columbus, Ohio 43216-0117

MiSource

Gas Standard

Distribution Operations

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EXHIBIT E
(1 of 6)

COLUMBIA GAS
Distribution Companies

Columbia Gas of Kentucky
Columbia Gas of Maryland
Columbia Gas of New York
Columbia Gas of Ohio
Columbia Gas of Pennsylvania
Commonwealth Gas Services

Date

Department of Transportation
Address
City, State Zip Code

Attention: Name
Title

SUBJECT: Project Name

Gentlemen:

We have enclosed, in septuple, a Preliminary Estimate in the amount of $161,575.00, and plans covering the proposed remedial work on the Columbia Gas of _____, Inc.'s gas pipeline necessitated by the proposed improvement of (project name), in the City of _____, _____ County, (State).

Our Company is not adequately staffed or equipped to perform this remedial work with our own forces at this time, and we hereby request State approval of our use of contract forces on a competitive basis.

This is to advise that our Company is operating the section of gas pipeline affected by the proposed highway improvement in accordance with the provisions set forth in those certain right of way agreements as follows:

GRANTOR	DATE	RECORDED-( ) COUNTY
A. A. Weinandy, etal.	4-17-62	Deed Volume 321, Page 137
Anthoni Visconsi, etal.	6-06-63	Deed Volume 325, Page 703

Please process the enclosed plan and estimate for approval, so that we may be authorized to proceed with the proposed remedial work.

Sincerely,

Name
Title

XXX:xxx

Enclosures: Preliminary Estimate - 7
Plan - 5

File: P.E.S. 183-2000-XXXX-XXXX

Columbia Gas Distribution Companies, 200 Civic Center Drive, P.O. Box 117, Columbus, Ohio 43216-0117

EXHIBIT E
(2 of 6)

ESTIMATE NO. 1

COMPANY: COLUMBIA GAS OF , INC.
ADDRESS: 200 Civic Center Drive
P.O. Box 117
Columbus, Ohio 43216-0117

COUNTY_____
ROUTE NO._____ Sec._____
UA NO._____ FED. PROJ. NO._____
WEST MARKET STREET

LINE NAME * WORK ORDER_____
WORK ORDER_____
* TOWN PLANT

PRELIMINARY ESTIMATE

Preliminary estimate covering the proposed remedial work on the Columbia Gas of , Inc.'s six (6) inch gas pipeline, Town Plant, necessitated by the proposed improvement of S.R. , in the City of , County,

A.	PRELIMINARY ENGINEERING			
	1. Labor			
	(a) Salaries and Wages	$ 947.00		
	(b) Additives	300.00		
	(c) Expense	47.00	$1,294.00	
	2. Supplies		-0-	
	3. Transportation		189.00	
	4. TOTAL			$1,483.00
B.	RIGHT OF WAY ACQUISITION			
	1. Property Costs		$5,680.00	
	2. Labor			
	(a) Salaries and Wages	$1,290.00		
	(b) Additives	409.00		
	(c) Expense	284.00	$1,983.00	
	3. Supplies		24.00	
	4. Transportation		710.00	
	5. TOTAL			$8,397.00

EXHIBIT E
(3 of 6)

ESTIMATE NO. 1

C.	TEMPORARY CONSTRUCTION			
	1. Labor			
	(a) Salaries and Wages	-0-		
	(b) Additives	-0-		
	(c) Expense	-0-		
	(d) Contract	-0-	-0-	
	2. Material (ITEMIZE)			
	(a) New Material	-0-		
	(b) Salvage	-0-		
	(c) Handling	-0-		
	(d) Depreciation	-0-	-0-	
	3. Equipment			
	(a) Company Owned	-0-		
	(b) Rented	-0-	-0-	
	4. TOTAL			-0-
D.	PERMANENT CONSTRUCTION			
	1. Labor			
	(a) Salaries and Wages	$12,169.00		
	(b) Additives	3,860.00		
	(c) Expense	947.00		
	(d) Contract	66,269.00	$83,245.00	
	2. Material (ITEMIZE)			
	(a) New Material	$28,723.00		
	(b) Salvage	-0-		
	(c) Handling	7,810.00	$36,533.00	
	3. Equipment			
	(a) Company Owned	$ 4,734.00		
	(b) Rented	-0-	$ 4,734.00	
	4. TOTAL			$124,512.00
E.	CONSTRUCTION ENGINEERING AND INSPECTION			
	1. Labor			
	(a) Salaries and Wages	$ 1,420.00		
	(b) Additives	451.00		
	(c) Expense	95.00	$ 1,966.00	
	2. Supplies		38.00	
	3. Transportation		324.00	
	4. TOTAL			$ 2,328.00

EXHIBIT E
(4 of 6)

F. ACCOUNTING — ESTIMATE NO. 1

1. Labor			
(a) Salaries and Wages	-0-		
(b) Additives	-0-		
(c) Expense	-0-		
		-0-	
2. Supplies		-0-	
3. Transportation		-0-	
4. TOTAL			-0-
G. ADMINISTRATION, INDIRECT OVERHEAD AND SUPERVISION Actual Costs Incurred in Accordance with Section 10-b of PPM 30-4 (See Explanation Sheet)			$ 24,855.00
H. GAS LOSS			-0-
I. TOTAL COST			$161,575.00
J. LESS BETTERMENT			-0-
K. TOTAL NET COST			$161,575.00
Percent (%) State Participation 59.65 %			$ 96,379.49
Percent (%) Company Participation 40.35 %			$ 65,195.51

DETAIL OF PERCENTAGE CALCULATION

3998 - Total length of existing gas pipeline affected by highway improvement.
-1613 - Total length of existing gas pipeline located within existing public right of way
2385 - Total length of existing gas pipeline located on private right of way.

$\frac{2385}{3998}$ = .5965 = 59.65 % (State Participation)

$\frac{1613}{3998}$ = .4035 = 40.35 % (Company Participation)

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EXHIBIT E
(5 of 6)

ESTIMATE NO. 1

MATERIAL

ITEM	QUANTITY	UNIT COST	AMOUNT
6" Steel Pipe	4,200'	2.88	$12,096.00
6" Shortstopp Tee	2	288.39	577.00
6" Gate Valve	2	606.58	1,213.00
6" Insulator, Weld End	1	317.09	317.00
17# Anodes, Magnesium	10	29.78	298.00
Coating & Wrapping	Lot		7,800.00
Miscellaneous Materials & Supplies			6,422.00
			$28,723.00

SALVAGE

ITEM	QUANTITY	UNIT COST	AMOUNT
* 8" Steel Pipe	395'	-0-	-0-
* 6" Steel Pipe	3,634'	-0-	-0-
* 6" Plug Valve	2	-0-	-0-

*NOTE: Existing pipe to be abandoned in the ground; since the costs for removing would exceed the salvage value of the reclaimed pipe.

-4-

EXHIBIT E
(6 of 6)

COLUMBIA GAS
Distribution Companies

Columbia Gas of Kentucky
Columbia Gas of Maryland
Columbia Gas of New York
Columbia Gas of Ohio
Columbia Gas of Pennsylvania
Commonwealth Gas Services

January 2, 1985

Department of Transportation
Address
City, State Zip Code

Attention: Name
Title

SUBJECT: Project Name

Gentlemen:

We have enclosed, in septuple, copies of bids received from three (3) pipeline contractors covering the contract portion of the proposed remedial work to be performed on the Columbia Gas of _____, Inc.'s gas pipeline necessitated by the proposed construction of (Project Name), in the City of _____, _____ County, (State).

The comparison of contractors' bids is as follows:

CONTRACTOR	TO BE INSTALLED
Don W. Bernard, Inc.	$ 66,435.00
The Coolsact Company	$ 73,525.00
R. L. Miller	$107,500.00

It is the recommendation of Columbia Gas of _____, Inc. that this remedial work be awarded to Don W. Bernard, Inc.

May we please have your concurrence with our recommendation for contract award.

Very truly yours,

Name
Title

XXX:xxx

Enclosures: Bids (3)

Columbia Gas Distribution Companies, 200 Civic Center Drive, P.O. Box 117, Columbus, Ohio 43216-0117

MiSource

Gas Standard

Distribution Operations

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EXHIBIT F

FORM C 1783 CSD (4-84)

COLUMBIA GAS DISTRIBUTION COMPANIES

COLUMBIA GAS OF_____, INC.

CHANGE ORDER AUTHORIZATION

CHANGE ORDER NUMBER	WORK ORDER NUMBER:
PROJECT:	DATE:

The following changes are authorized for the above named project: (Attach sketch if applicable)

COST ESTIMATE: (If Available)

REASON:_____

APPROVALS:

FOR COMPANY_____ (SIGNATURE) TITLE_____ DATE_____

FOR PROJECT_____ (SIGNATURE) TITLE_____ DATE_____

FOR CO. CONTRACTOR_____ (SIGNATURE) TITLE_____ DATE_____

ORIGINAL: To be attached to Completion Report
BLUE COPY: Land Section
PINK COPY: Retained by District
YELLOW COPY: To Project Representative and/or Contractor

NiSource

Distribution Operations

Gas Standard

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EXHIBIT G
(1 of 2)

32-0-21-107-0561-7621-6630

APRIL, 1985 PA3540

C O L U M B I A G A S S Y S T E M
DISTRIBUTION COMPANIES
WORK-IN-PROGRESS LEDGER
COLUMBIA GAS OF KENTUCKY, INC.
MONTHLY REIMBURSABLE WORK ORDER LISTING

PAGE 142

CO	Z	ST	GEN	BUD AUX	LOC SUB	W/O OTH	TC	CE	REC TYP	SEQ-NO	GAS PLANT ACCOUNT	TAX DIST	RATE MKNG DIST	BLK	CPR ID	MAP NO	DTE W/O START	DTE W/O ISSUED	PREV IN-SRV DTE	IN SRV DTE	IS CD	DTE COMPT RPT REC	PRT
32	0	21	107-0561-7621-6630				00	00	00	000000	37600	0674802	0000	0	0674802	V-930-120	12-10-84	10-00-84	00-00	03-21-85	0	00-00-00	E

DESCRIPTION AND LOCATION	DTE LST ACT	DTE W/O CLOSED	RET	REM	TO/ FRM	ACCOUNT RE-CLASS	DEL	REC	CNT	OVR	AUTH AMT	IN-SRV DOLLARS
LAY 286' 8"WT & 208' 4"WT HP MAIN MASON HEADLEY	04-30-85	00-00-00	00	1	0	000000000000000000000	0	0	1	1	27,186	

SR	SEQ NO	VOUCHER REF OR TRANS NO	SRC	CO BL	VOU TRAN	EMP AUTO LOC	PROP. NUMBER	UNIT ID PAY LOC	SSN / OCCP CODE	UM MATERIAL DESCRIPTION / BASE AMT	RAW LABOR	VAC ACCR	OVERHEAD	CE	HOURS OR QUAN	UNIT PRICE OR RATE PER HR	AMOUNT
01	000001	12-2001-84	00	00	0000	9212		1621	9262	11095	9686	1407	3278	21	8.00	12.10750	110.93
01	000002	12-2001-84	00	00	0000	9311		1621	9262	59298	51775	7523	17525	21	43.00	12.04060	592.98
01	000004	01-2001-85	00	00	0000	9311		1621	9262	42515	36928	5587	13490	21	32.00	11.54000	425.15
01	000006	02-2001-85	00	00	0000	9311		1621	9262	10629	9232	1397	3373	21	8.00	11.54000	106.29
01	000008	03-2001-85	00	00	0000	9368		1621	9280	2502	2173	329	794	21	2.00	10.86620	25.02
01	000009	03-2001-85	00	00	0000	9447		1621	9220	27920	24251	3669	8859	21	18.00	13.47250	279.20
01	000010	03-2001-85	00	00	0000	9717		1621	9220	27920	24251	3669	8859	21	18.00	13.47250	279.20
01	000011	03-2001-85	00	00	0000	9311		1621	9262	67254	58416	8838	21340	21	49.00	11.92170	672.54
													TOTAL LABOR	21		################	2,491.31
01	000003	12-2001-84	00	00	0000	0000		0000	0000					22	.00	.00000	208.03
01	000005	01-2001-85	00	00	0000	0000		0000	0000					22	.00	.00000	134.90
01	000007	02-2001-85	00	00	0000	0000		0000	0000					22	.00	.00000	33.73
01	000012	03-2001-85	00	00	0000	0000		0000	0000					22	.00	.00000	398.52
													TOTAL LABOR OVERHEAD	22		################	775.18
03	000001	12-2003-84	00	00	0000	2003								31		3.05000	155.55
03	000002	01-2003-85	00	00	0000	2003								31		3.00000	96.00
03	000003	02-2003-85	00	00	0000	2003								31		3.00000	24.00
03	000004	03-2003-85	00	00	0000	2003								31		3.00000	261.00
													TOTAL AUTOMOTIVE TRANSPORTATION - CLEARED	31		################	536.55
02	000070	04-3728-85	05	00	0000	0404			00-00-000	WILLIS				32		10.9400	10.94
02	000071	04-3728-85	05	00	0000	0404			00-00-000	WALLING				32		12.5300	12.53

32-0-21-107-0561-7621-6630

32-0-21-107-0561-7621-6630

APRIL, 1985 PA3540

C O L U M B I A G A S S Y S T E M
DISTRIBUTION COMPANIES
WORK-IN-PROGRESS LEDGER
COLUMBIA GAS OF KENTUCKY, INC.
MONTHLY REIMBURSABLE WORK ORDER LISTING

PAGE 143

SR	SEQ NO	VOUCHER REF OR TRANS NO	SRC	CO BL	VOU TRAN	EMP AUTO LOC	SSN / OCCP CODE	UM	MATERIAL DESCRIPTION	CE	HOURS OR QUAN	UNIT PRICE OR RATE PER HR	AMOUNT
02	000072	04-3728-85	05	00	0000	0404	00-00-000		WRIGHT	32		12.5300	12.53
									TOTAL EMPLOYEE EXPENSE	32		################	36.00
04	000005	03-2004-85	00	00	1225					33			14.40
									TOTAL GENERAL TOOLS - CLEARED	33		################	14.40
02	000015	01-2452-85	05	00	0000	0404	00-00-000		PLUMBING SUPPLIES	71		116.5500	116.55
02	000004	12-2002-84	00	00	0304	2621	07-22-216	FT	4 1/2 P PE EH B 188	71	210	1.9080	400.36
02	000005	12-2002-84	00	00	0265	2621	07-22-356	FT	8 5/8 P PE EH B 188	71	330	3.5420	1,169.16
02	000031	02-2002-85	00	00	0160	2621	11-64-373	EA	4 G/V HE 500 S FP	71	1	394.4560	394.44
02	000032	02-2002-85	00	00	0160	2621	11-64-406	EA	1 G/V HE 720 S FP	71	3	155.3600	466.08
02	000060	03-2002-85	00	00	0307	2621	11-64-406	EA	1 G/V HE 720 S FP	71	2	155.3600	310.72
02	000001	12-2002-84	00	00	0389	2621	17-05-169	EA	4 CAP 188	71	2	5.2800	10.56
02	000017	02-2002-85	00	00	0160	2621	17-05-169	EA	4 CAP 188	71	1	5.1580	5.16
02	000056	03-2002-85	00	00	0307	2621	17-05-169	EA	4 CAP 188	71	1	5.1580	5.16
02	000020	02-2002-85	00	00	0160	2621	17-05-223	EA	6 CAP 219	71	2	8.7860	17.57
02	000058	03-2002-85	00	00	0307	2621	17-05-223	EA	6 CAP 219	71	2	8.7860	17.57
02	000012	01-2002-85	00	00	0421	2621	17-05-289	EA	8 CAP 219	71	1	13.6300	13.63
02	000016	02-2002-85	00	00	0159	2621	17-15-127	EA	3 ELL 90 LR 216	71	1	4.8230	4.82
02	000025	02-2002-85	00	00	0151	2621	17-15-275	EA	8 ELL 90 LR 322	71	2	70.0000	140.00
02	000026	02-2002-85	00	00	0159	2621	17-15-275	EA	8 ELL 90 LR 322	71	2	70.0000	140.00
02	000022	02-2002-85	00	00	0159	2621	17-51-269	EA	8X4 RED CN 219X188	71	1	40.3500	40.55
02	000023	02-2002-85	00	00	0162	2621	17-51-283	EA	8X6 RED CN 219X219	71	2	33.8500	67.70
02	000024	02-2002-85	00	00	0159	2621	17-79-289	EA	8 TEE 219	71	1	73.3750	73.38
02	000033	02-2002-85	00	00	0159	2621	19-02-288	EA	8F WN F-I 300 RF188	71	2	493.7300	987.46
02	000055	03-2002-85	00	00	0307	2621	24-39-120	EA	1 NIP XS SM	71	2	1.6040	3.21
02	000057	03-2002-85	00	00	0307	2621	26-02-120	EA	1 FITTING PIPE	71	3	1.8560	3.57
02	000019	02-2002-85	00	00	0159	2621	42-09-003	GL	PRIMER PIPE	71	1	13.8930	13.89
02	000029	02-2002-85	00	00	0159	2621	42-10-004	RL	4X50 TAPE COAL TAR	71	24	8.5230	204.57
02	000002	12-2002-84	00	00	0304	2621	42-14-045	FT	4 1/2 CTG/WRP M-APP	71	210	.5300	111.44
02	000003	12-2002-84	00	00	0265	2621	42-14-085	FT	8 5/8 CTG/WRP M-APP	71	330	.8360	275.95
02	000034	02-2002-85	00	00	0160	2621	42-21-171	EA	8 STPR MLR H17255	71	2	507.2000	1,014.40
02	000061	03-2002-85	00	00	0186	2621	42-21-171	EA	8 STPR MLR H17255	71	1	507.2000	507.20
02	000030	02-2002-85	00	00	0160	2621	42-25-130	EA	4 SHTSH-TS WMSN	71	1	236.7460	236.75
02	000027	02-2002-85	00	00	0159	2621	42-31-217	EA	ANODE MAG PKGD HP170	71	6	31.2570	187.54
02	000028	02-2002-85	00	00	0231	2621	42-31-217	EA	ANODE MAG PKGD HP170	71	6	31.2570	187.54
02	000018	02-2002-85	00	00	0160	2621	42-53-306	RL	6X1800TP PE MRKR ALN	71	1	15.7420	15.74
02	000021	02-2002-85	00	00	0160	2621	44-61-025	EA	4 BOX VALVE COMPLETE	71	1	37.4000	37.40

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Distribution Operations

Gas Standard

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 22 of 31

EXHIBIT G
(2 of 2)

32-0-21-107-0561-7621-4638 C O L U M B I A G A S S Y S T E M PAGE 144
APRIL, 1985 PA3540 DISTRIBUTION COMPANIES
WORK-IN-PROGRESS LEDGER
COLUMBIA GAS OF KENTUCKY, INC.
MONTHLY REIMBURSABLE WORK ORDER LISTING

SR	SEQ NO	VOUCHER REF OR TRANS NO	S R C	CD BL	YOU TRAN	EMP AUTO LOC	PROP. UNIT NUMBER	ID PAY LOC	SSN OCCP CODE	UM	MATERIAL DESCRIPTION BASE AMT	RAM LABOR	VAC ACCR	OVERHEAD	CE	HOURS OR QUAN	UNIT PRICE OR RATE PER HR	AMOUNT
02	000059	03-2002-65	00	00	0271	2621			44-61-025	EA	4 BOX VALVE COMPLETE				71	2	37.5000	75.00
											TOTAL MATERIAL AND SUPPLIES - GENERAL				71	XXXXXXXXXXXXXXXX		7,260.57
02	000006	12-2002-64	00	00	0000	0000			00-00-000	00					72		.0000	.01
02	000007	12-2002-64	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	2.64
02	000008	12-2002-64	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	27.66
02	000009	12-2002-64	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	64.95
02	000010	12-2002-64	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	100.22
02	000011	12-2002-64	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	292.25
02	000013	01-2002-65	00	00	0000	0000			00-00-000	00					72		.0000	.01
02	000014	01-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	.01
02	000035	02-2002-65	00	00	0000	0000			00-00-000	00					72		.0000	5.41
02	000036	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	.01
02	000037	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	1.22
02	000038	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	1.25
02	000039	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	5.94
02	000040	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	5.97
02	000041	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	4.35
02	000042	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	9.45
02	000043	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	10.14
02	000044	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	14.91
02	000045	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	18.32
02	000046	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	35.00
02	000047	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	35.00
02	000048	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	44.65
02	000049	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	44.85
02	000050	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	51.14
02	000051	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	58.51
02	000052	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	98.65
02	000053	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	116.32
02	000054	02-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	246.87
02	000062	03-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	253.66
02	000063	03-2002-65	00	00	0000	0000			00-00-000	00					72		.0000	.01
02	000064	03-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	.01
02	000065	03-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	1.27
02	000066	03-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	3.56
02	000067	03-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	4.35
02	000068	03-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	18.90
02	000069	03-2002-65	00	00	0000	0000			00-00-000		STORES GVHD/STOCK				72		.0000	77.68
																		126.85

32-0-21-107-0561-7621-4638

32-0-21-107-0561-7621-4638 C O L U M B I A G A S S Y S T E M PAGE 145
APRIL, 1985 PA3540 DISTRIBUTION COMPANIES
WORK-IN-PROGRESS LEDGER
COLUMBIA GAS OF KENTUCKY, INC.
MONTHLY REIMBURSABLE WORK ORDER LISTING

SR	SEQ NO	VOUCHER REF OR TRANS NO	S R C	CD BL	YOU TRAN	EMP AUTO LOC	PROP. UNIT NUMBER	ID PAY LOC	SSN OCCP CODE	UM	MATERIAL DESCRIPTION BASE AMT	RAM LABOR	VAC ACCR	OVERHEAD	CE	HOURS OR QUAN	UNIT PRICE OR RATE PER HR	AMOUNT
											TOTAL MATERIAL AND SUPPLIES - STORES COST - CLEARED				72	XXXXXXXXXXXXXXXX		1,786.04
04	000001	01-2037-65	00	00	0000										98			210.28
04	000003	02-2037-65	00	00	0000										98			47.05
04	000006	03-2037-65	00	00	0000										98			325.41
04	000008	04-2037-65	00	00	0000										98			183.98
											TOTAL CONSTRUCTION OVERHEADS (S & E AND A & G)				98	XXXXXXXXXXXXXXXX		766.56
04	000002	01-2037-65	00	00	0000										91			19.47
04	000004	02-2037-65	00	00	0000										91			44.47
04	000007	03-2037-65	00	00	0000										91			80.40
04	000009	04-2037-65	00	00	0000										91			74.24
											TOTAL ALLOWANCE FOR FUNDS DURING CONSTRUCTION (INTEREST)				91	XXXXXXXXXXXXXXXX		218.58
																	TOTAL MATERIAL		7,260.57
																	TOTAL OTHER		6,424.62
																	TOTAL CLOSING		.00
																	TOTAL WORK ORDER		13,685.19

REC TYPE	SEQ NO	W/O REC CNT	MTL. AMOUNT	BASE AMOUNT	TOTAL INTEREST	TOTAL EXCLUDED CHARGES	CLOSING AMOUNT	TOTAL BALANCE	NO. OF MONTHS
10	000000	98	.00	13,666.61	218.58	.00	.00	13,685.19	7

CUR. MO. CHARGES	CUR. MO. INTEREST	CUR. MO. OVERHEAD	CUR. MO. EXCL.CHGS.	C	MO	YR	CUR. MO. CHARGES	CUR. MO. INTEREST	CUR. MO. OVERHEAD	CUR. MO. EXCL.CHGS.	C	MO	Y
.00	.00	.00	.00		10	84	.00	.00	.00	.00		11	8
3,527.43	.00	.00	.00		12	84	789.64	19.47	210.28	.00		1	8
5,440.82	44.47	47.05	.00		2	85	3,686.16	80.40	325.41	.00		3	8
16.88	74.24	183.98	.00		4	85							

32-0-21-107-0561-7621-4638

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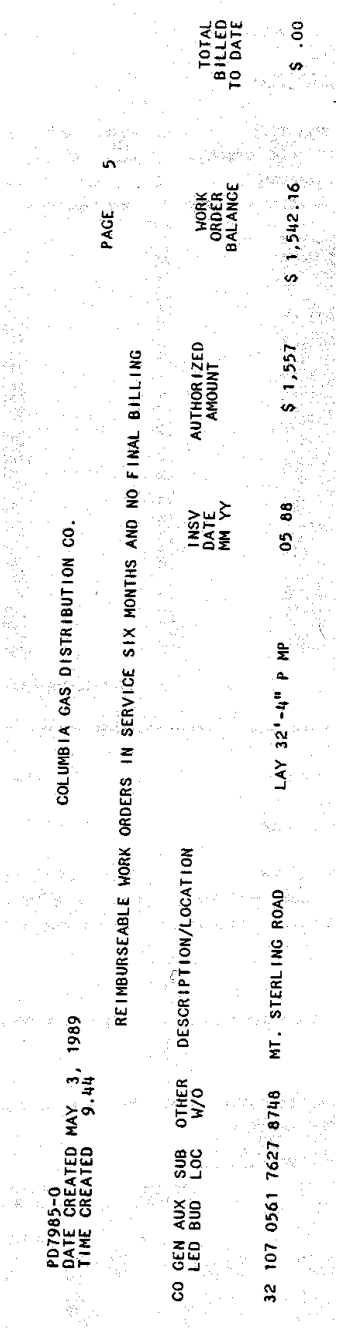
EXHIBIT H



PD7985-O
DATE CREATED MAY 3, 1989
TIME CREATED 9.44

COLUMBIA GAS DISTRIBUTION CO.

PAGE 5

REIMBURSEABLE WORK ORDERS IN SERVICE SIX MONTHS AND NO FINAL BILLING

CO	GEN LED	AUX BUD	SUB LOC	OTHER W/O	DESCRIPTION/LOCATION	INSV DATE MM YY	AUTHORIZED AMOUNT	WORK ORDER BALANCE	TOTAL BILLED TO DATE
32	107	0561	7627	8748	MT. STERLING ROAD LAY 32'-4" P MP	05 88	$ 1,557	$ 1,542.16	$ .00

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 24 of 31

EXHIBIT I
(1 of 4)

Instructions for completing Form C 2695, "Journal Voucher Sub."

The following are keyed to Form C 2695, page 2 of this Exhibit for items to be entered on "Voucher".

Key	Item	Description
1	Company	Self-explanatory
2	Month of --	Enter month and year submitted to Asset Accounting
3	Account Classification	Enter on line one Account No. 143-9-2-(District Number). Skip one line and enter only the 107 Work Order Number(s) associated with the billing.
4	Debit	Enter against Account No. 143-9-2-(District Number) the total of the amount being billed. If more than one Work Order is involved, total the debit.
5	Credit	Enter against the Work Order(s) the amount being billed. If more than one Work Order is involved, total the credits. Note: Credit total must equal Debit.
6	"Project"	Provide project name for identification and list all related Work Orders.
7	"Billing Status"	Indicate "Final or Partial".
8	"Tax Status"	Indicate "Taxable" or "Non-taxable".
9	"Statement"	Enter the following appropriately completed: To record the transfer to Accounts Receivable of charges to a reimbursable Work Order. These charges represent the costs incurred by Columbia Gas of _____, Inc. to relocate their facilities at the request of _____. See attached detail.
10	Compiled By	Indicate name of person compiling voucher.
11	Verified By	Indicate name of person verifying voucher.
12	Approved By	Indicate name of person verifying voucher. To be signed by District Plant Manager.

Note: Page 3 of 4 reflects a completed Form C 2695 for a single 107/108 Work Order project whereas Page 4 of 4 reflects a multiple 107/108 Work Order project.

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Gas Standard

Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 25 of 31

EXHIBIT I
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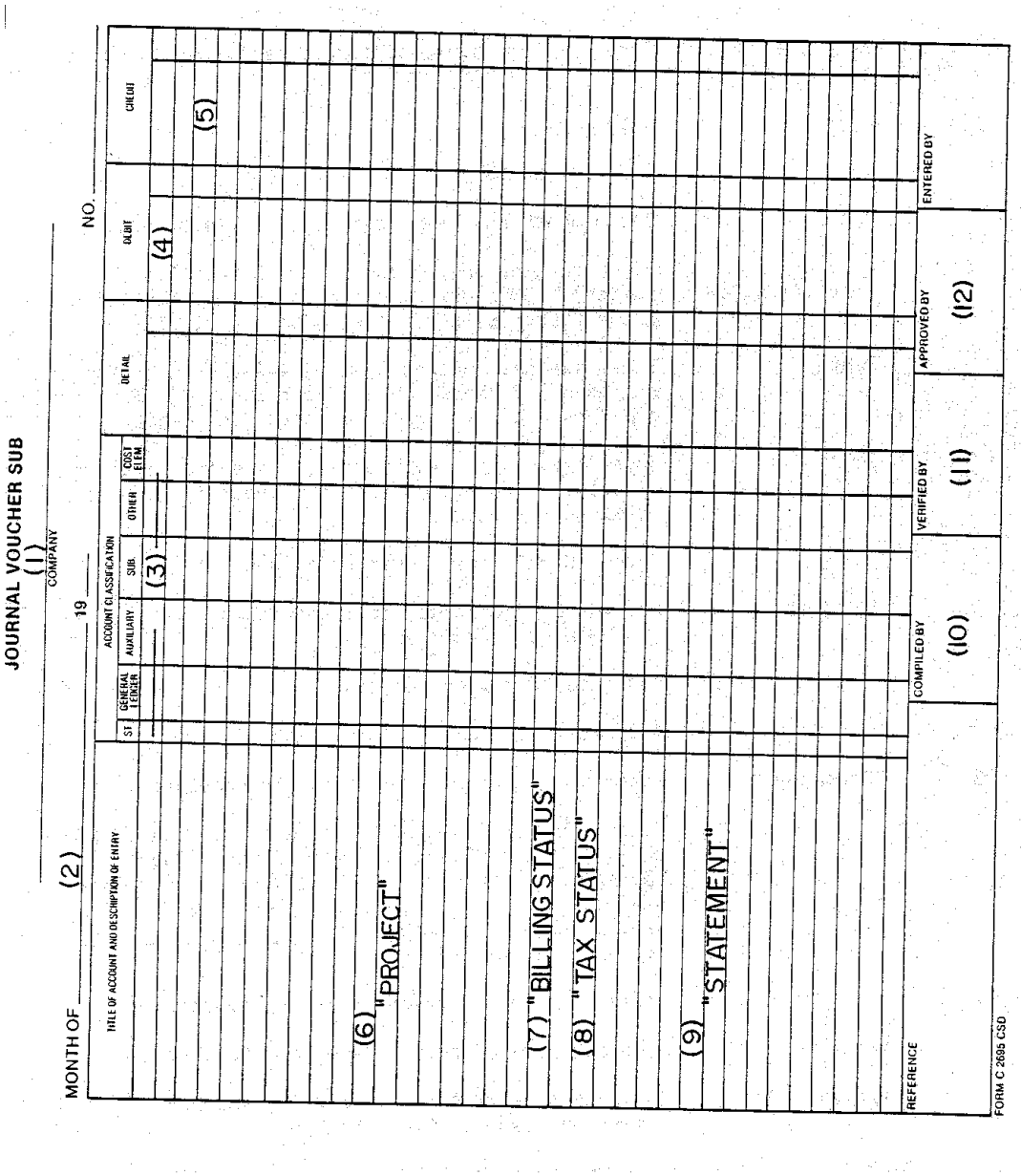


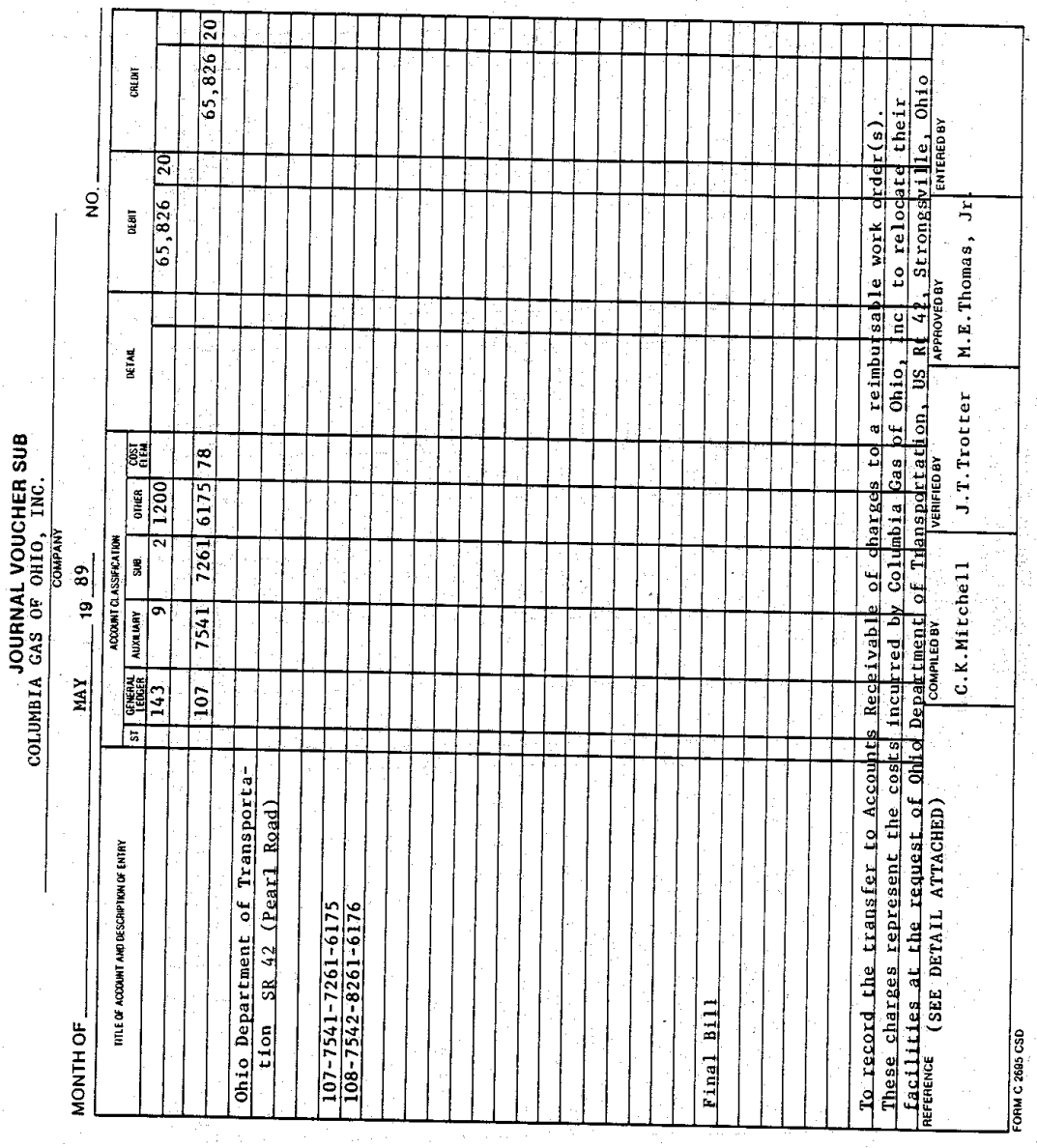
MiSource

Gas Standard

Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 26 of 31

EXHIBIT I
(3 of 4)



JOURNAL VOUCHER SUB
COLUMBIA GAS OF OHIO, INC.
COMPANY

MONTH OF MAY 19 89 NO.

TITLE OF ACCOUNT AND DESCRIPTION OF ENTRY	ST	ACCOUNT CLASSIFICATION: GENERAL LEDGER	AUXILIARY	SUB	OTHER	COST ELEM	DETAIL	DEBIT	CREDIT
		143	9	2	1200			65,826 20	
		107	7541	7261	6175	78			65,826 20
Ohio Department of Transportation SR 42 (Pearl Road)									
107-7541-7261-6175									
108-7542-8261-6176									
Final Bill									
To record the transfer to Accounts Receivable of charges to a reimbursable work order(s). These charges represent the costs incurred by Columbia Gas of Ohio, Inc. to relocate their facilities at the request of Ohio Department of Transportation, US Rt 42, Strongsville, Ohio									

REFERENCE (SEE DETAIL ATTACHED) | COMPILED BY G.K.Mitchell | VERIFIED BY J.T.Trotter | APPROVED BY M.E.Thomas, Jr. | ENTERED BY

FORM C 2685 CSD

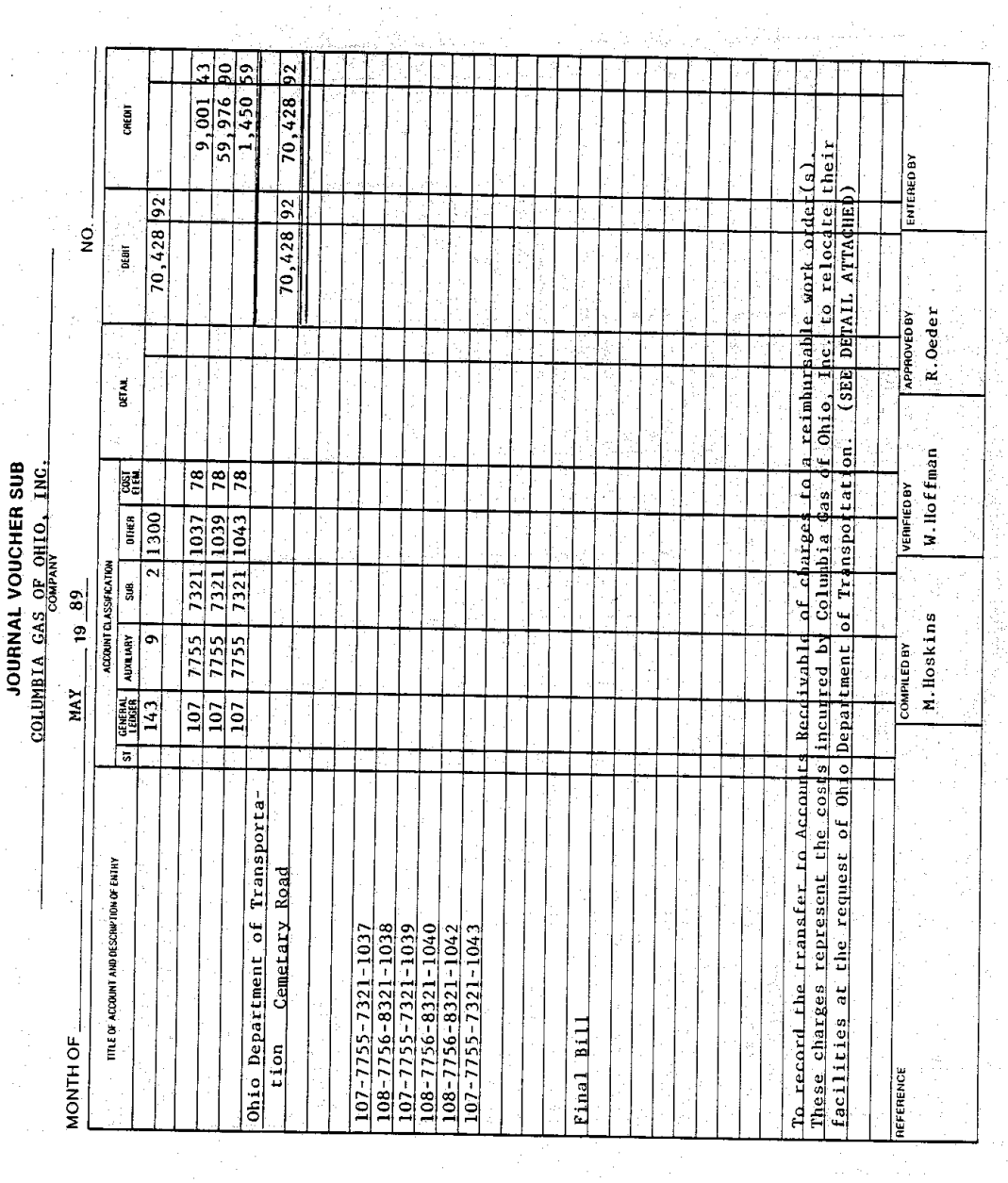
MiSource

Gas Standard

Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 27 of 31

EXHIBIT I
(4 of 4)



JOURNAL VOUCHER SUB

COLUMBIA GAS OF OHIO, INC.
COMPANY

MONTH OF MAY 19 89 NO.

TITLE OF ACCOUNT AND DESCRIPTION OF ENTRY	ST	ACCOUNT CLASSIFICATION: GENERAL LEDGER	ADD'L MAY	SUB.	OTHER	COST ELEM.	DETAIL	DEBIT	CREDIT
		143	9	2	1300			70,428 92	
		107	7755	7321	1037	78			9,001 43
		107	7755	7321	1039	78			59,976 80
		107	7755	7321	1043	78			1,450 59
Ohio Department of Transportation Cemetary Road								70,428 92	70,428 92
107-7755-7321-1037									
108-7756-8321-1038									
107-7755-7321-1039									
108-7756-8321-1040									
108-7756-8321-1042									
107-7755-7321-1043									
Final Bill									
To record the transfer to Accounts Receivable of charges to a reimbursable work order(s). These charges represent the costs incurred by Columbia Gas of Ohio, Inc. to relocate their facilities at the request of Ohio Department of Transportation. (SEE DETAIL ATTACHED)									

REFERENCE

COMPILED BY M.Hoskins

VERIFIED BY W.Hoffman

APPROVED BY R.Oeder

ENTERED BY

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 28 of 31

EXHIBIT J

COLUMBIA GAS
Distribution Companies

REMIT PAYMENT TO:
Columbia Gas of KY, Inc.
CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

DATE 6/6/85

CUSTOMER'S ORDER

PAYABLE UPON RECEIPT

IN ACCOUNT WITH

Lexington/Fayette Urban County Government
Division of Engineering
200 East Main Street
Lexington, Kentucky, 40507

ATTN: Jack Edmiston

FORM C 7-1 CSD (9-82)

REMIT PAYMENT TO:
Columbia Gas of KY, Inc
CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

INVOICE NO. LS-1600-20

VOUCHER NO.

REFERENCE Mason Headley

IN ACCOUNT WITH

Lexington/Fayette Urban
County Government

AMOUNT $ 1,650.00
PLEASE RETURN THIS COUPON WITH YOUR REMITTANCE

Cost of Relocation of 6-5/8" Gas Main, Mason Headly Road

Per:

Your Purchase Order No. B00654

Our Work Order Numbers:

107-561-7621-6630
108-562-8621-6629

Total Amount Due Columbia Gas of Kentucky, Inc. = $1,650.00
(Final Billing)

Note: Bills shall reflect payment to Finance - Cash Management. If a payment is made directly to the District, the "Daily Cash Report" shall reflect the payment under Account 143-9-2-(District Location). In addition, the billing stub shall be forwarded to Cash Management in order for the appropriate Work Order under Account 143-9-2 to be credited.

Invoices shall reflect the Work Order Number.

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 29 of 31

EXHIBIT K

COLUMBIA GAS of Ohio

REMIT PAYMENT TO:

COLUMBIA GAS OF OHIO, INC.
CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

DATE

CUSTOMER'S ORDER

PAYABLE UPON RECEIPT

IN ACCOUNT WITH

FORM C 7-1A CSD (9-82)

REMIT PAYMENT TO:

COLUMBIA GAS OF OHIO, INC.
CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

INVOICE NO.

VOUCHER NO.

REFERENCE

IN ACCOUNT WITH

AMOUNT $

PLEASE RETURN THIS COUPON WITH YOUR REMITTANCE

COLUMBIA GAS Distribution Companies

REMIT PAYMENT TO:

CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

DATE

CUSTOMER'S ORDER

PAYABLE UPON RECEIPT

IN ACCOUNT WITH

FORM C 7-1 CSD (9-82)

REMIT PAYMENT TO:

CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

INVOICE NO.

VOUCHER NO.

REFERENCE

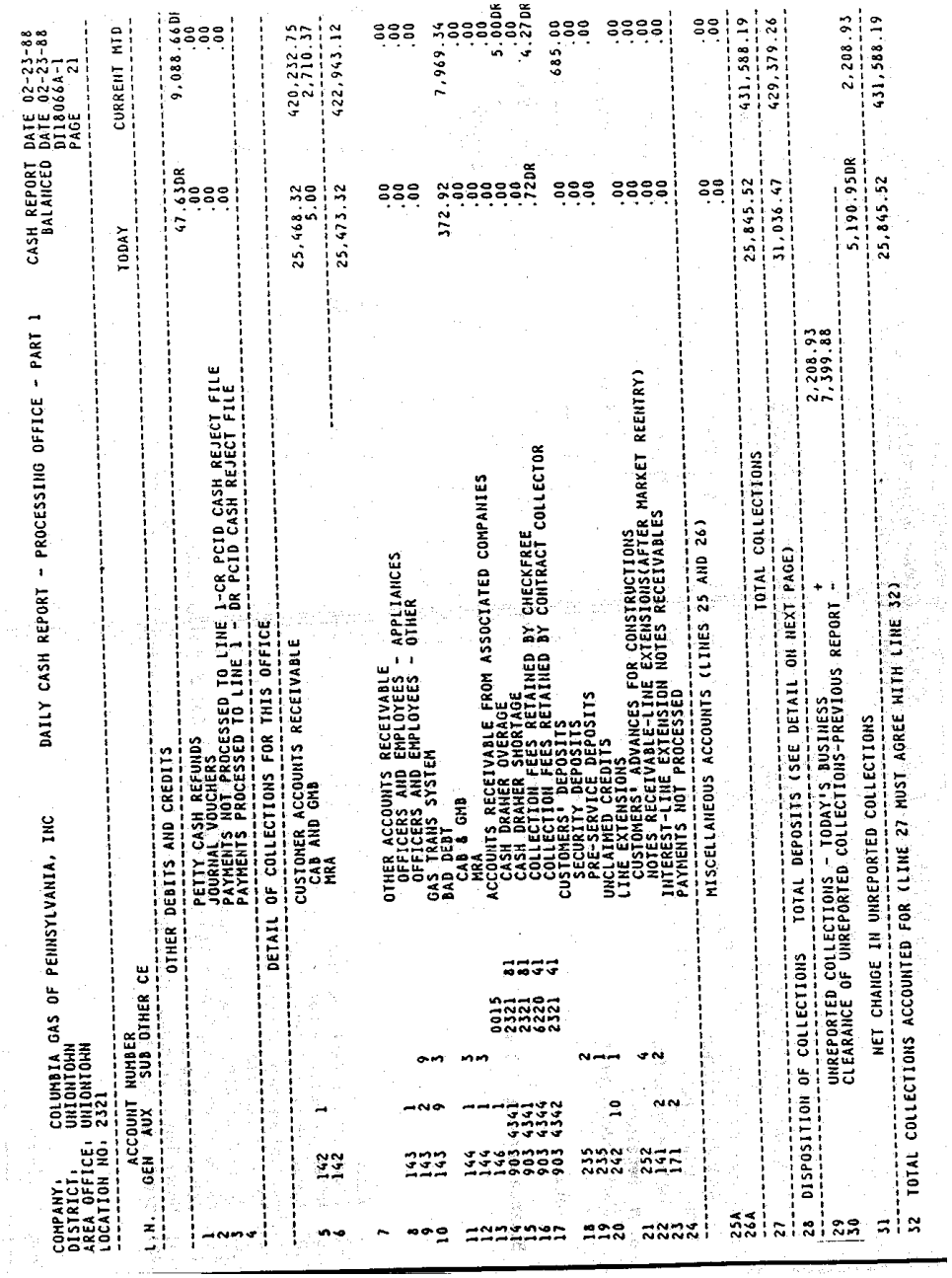
IN ACCOUNT WITH

AMOUNT $

PLEASE RETURN THIS COUPON WITH YOUR REMITTANCE

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 30 of 31

EXHIBIT L



COMPANY: COLUMBIA GAS OF PENNSYLVANIA, INC DAILY CASH REPORT - PROCESSING OFFICE - PART 1 CASH REPORT DATE 02-23-88
DISTRICT: UNIONTOWN BALANCED DATE 02-23-88
AREA OFFICE: UNIONTOWN DI18066A-1
LOCATION NO. 2321 PAGE 21

L.N.	ACCOUNT NUMBER GEN	AUX	SUB	OTHER	CE		TODAY	CURRENT MTD
						OTHER DEBITS AND CREDITS		
							47.63DR	9,088.66DR
1						PETTY CASH REFUNDS	.00	.00
2						JOURNAL VOUCHERS	.00	.00
3						PAYMENTS NOT PROCESSED TO LINE 1-CR PCID CASH REJECT FILE		
4						PAYMENTS PROCESSED TO LINE 1 - DR PCID CASH REJECT FILE	.00	
						DETAIL OF COLLECTIONS FOR THIS OFFICE		
						CUSTOMER ACCOUNTS RECEIVABLE	25,468.32	420,232.75
5	142	1				CAB AND GMB	5.00	2,710.37
6	142					MRA		
							25,473.32	422,943.12
7						OTHER ACCOUNTS RECEIVABLE	.00	.00
8	143	1		9		OFFICERS AND EMPLOYEES - APPLIANCES	.00	.00
9	143	2		3		OFFICERS AND EMPLOYEES - OTHER	.00	.00
10	143	9				GAS TRANS SYSTEM	372.92	7,969.34
						BAD DEBT	.00	.00
11	144	1		3		CAB & GMB	.00	.00
12	144	1		3		MRA	.00	5,000DR
13	146	1				ACCOUNTS RECEIVABLE FROM ASSOCIATED COMPANIES	.00	.00
14	903	4341			0015	CASH DRAWER OVERAGE	.00	4.27DR
15	903	4341			2321	CASH DRAWER SHORTAGE	.72DR	
16	903	4344			6220	COLLECTION FEES RETAINED BY CHECKFREE		
17	903	4342			2321	COLLECTION FEES RETAINED BY CONTRACT COLLECTOR		
						CUSTOMERS' DEPOSITS	.00	685.00
18	235			2		SECURITY DEPOSITS	.00	.00
19	235			1		PRE-SERVICE DEPOSITS	.00	
20	242	10		1		UNCLAIMED CREDITS		
						LINE EXTENSIONS	.00	.00
21	252			4		CUSTOMERS' ADVANCES FOR CONSTRUCTIONS	.00	.00
22	141	2		2		NOTES RECEIVABLE-LINE EXTENSIONS(AFTER MARKET REENTRY)	.00	.00
23	171	2				INTEREST-LINE EXTENSION NOTES RECEIVABLES	.00	
24						PAYMENTS NOT PROCESSED		
						MISCELLANEOUS ACCOUNTS (LINES 25 AND 26)	.00	.00
25A							.00	.00
26A								
27						TOTAL COLLECTIONS	25,845.52	431,588.19
28	DISPOSITION OF COLLECTIONS TOTAL DEPOSITS (SEE DETAIL ON NEXT PAGE)						31,036.47	429,379.26
	UNREPORTED COLLECTIONS - TODAY'S BUSINESS					+	2,208.93	
29	CLEARANCE OF UNREPORTED COLLECTIONS-PREVIOUS REPORT -						7,399.88	2,208.93
30							5,190.95DR	
	NET CHANGE IN UNREPORTED COLLECTIONS							
31							25,845.52	431,588.19
32	TOTAL COLLECTIONS ACCOUNTED FOR (LINE 27 MUST AGREE WITH LINE 32)							

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/05/1990	**Relocation Projects - Governmental Agencies**	Standard Number: **GS 2850.010(CG)** P&P 626-1
Supercedes: N/A		Page 31 of 31

EXHIBIT M

COLUMBIA GAS OF PENNSYLVANIA, INC.

OTHER ACCOUNTS RECEIVABLE - District Reimburseable Billings AS OF
(Account 143-9-2)

NAME - Work OrderNumber	CURRENT Billed Amount	NON - CURRENT PRIOR MONTH	NON - CURRENT TWO MONTHS TO 1 YEAR	NON - CURRENT OVER 1 YEAR	TOTAL
Patton-Ferguson Joint Authority	$ -	$ -	$ 1,589.26 (B)	$ -	1,589.26
Work Order Number					
Pennsylvania Dept. of Transportation	-	-	32,606.75 (B)	-	32,606.75
Work Order Number					
W. W. Developers	-	-	772.87 (B)	-	772.87
Work Order Number					
Total	$ -	$ -	$34,968.88	$ -	$34,968.88
Balance Account 143-9-2					$34,968.88

(A) Paid
(B) Under Credit Dept. review
(C) Under Law Dept. review
(D) Under District Office review
(E) Partial payment received
(F) To be corrected
(G) Payment pending insurance company decision
(H) 2% above prime rate at Morgan Guaranty & Trust Co. adjusted monthly
(I) Collection Agency
(J) Under Motor Transportation Review
(K) Settlement Date 6/30/89

WPS/FIN:GA-0007

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 1 of 21

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL INFORMATION

When requests are received from an outside non-governmental agency or party requesting the relocation of Company facilities, a determination shall be made prior to construction as to whether these relocations will be made at the Company's expense or at the expense of the party requesting these relocations.

Governmental relocation requests are handled in accordance with GS 2850.010(CG) "Relocation Projects - Governmental Agencies."

Company service line relocation requests are handled in accordance with GS 2850.014(CG) "Relocation of Company Service Lines per Customer Request."

The District shall determine whether the Company is eligible for reimbursement. Generally the Company is eligible for reimbursement when Company facilities are located on private rights-of-way, or in public right-of-way and the party requesting relocation is not the governmental agency having jurisdiction over the public right-of-way.

The manager or supervisor making the determination of eligibility for reimbursement should be aware that:

a. Although the Company facility may now be located in public rights-of-way, the initial installation may have been made on private right-of-way.

b. There may be prior rights on public rights-of-way.

NOTE: If any question exists as to prior rights, contact Engineering - Land Section to research records.

An agreement for reimbursement shall be completed before the start of construction to prevent potential loss of reimbursement.

Effective Date: 07/16/1991	Relocation Projects - Others	Standard Number: GS 2850.012(CG) P&P 626-2
Supersedes: N/A		Page 2 of 21

2. REQUEST FOR ASSISTANCE

When the District requires assistance, Form C 1434, “Request for Service,” Exhibit A, shall be completed and forwarded to Engineering - Civil Engineering Director. Attach to Form C 1434 a copy of the request, if written, and a sketch of affected facilities. The following should be included on Form C 1434:

a. Name and address of person making request if an oral request
b. Name(s) of present and former land owner if known
c. Operation Map number
d. Location (street, city, country, township, etc.)
e. Purpose of request

Upon receipt of Form C 1434, Engineering - Land Section shall advise the District whether or not the Company is eligible for reimbursement. The decision of whether to bill shall be in accordance with the level of approval for Work Orders.

3. RELOCATION AT COMPANY'S EXPENSE

The District will initiate a Preliminary Survey and Investigation (PS&I) Work Order if it is necessary to accumulate costs before a non-reimbursable Work Order(s) is issued when the relocation will be made at Company's expense.

4. RELOCATION AT OTHERS' EXPENSE

4.1 PS&I Work Order

If the relocation is determined to be reimbursable, a PS&I Work Order may be issued by the District.

The PS&I Work Order can be used to accumulate charges for reimbursement negotiations, required surveying, rights-of-way acquisition, and cost estimating.

4.2 Reimbursement Agreements

There are three methods by which a District can enter into an agreement after giving consideration to the credit worthiness of the requesting party and the nature and cost of the relocation project. They are:

a. execute Form C-1623, "Agreement", Exhibit B.

b. negotiate, confirmed by letter agreement, with requesting party. Based on the relocation cost estimate, a lump sum payment in advance of construction will be obtained. Under this method, adjustments may or may not be made based on actual cost.

c. obtain a letter of commitment for total actual cost to be paid after work is completed.

NOTE: Method a. is preferred. Method b. is preferred over Method c., since reimbursement is secured prior to start of construction.

4.3 Processing

Each of the methods outlined in Section 4.2 is to be processed as follows:

4.3.1 Form C-1623, "Agreement"

Form C-1623, Exhibit B, is prepared by the District and then executed by the requesting party, who will also make the stipulated advance payment. The District will then have Form C-1623 executed by the Company according to the Manual of Managerial Approvals, number it in accordance with applicable Supply Chain processes, and issue the necessary Work Orders.

The initial payment will be processed by attaching the check to Form C-998, "Notice of Receipt of Payment for Miscellaneous Accounts Receivable," Exhibit C. Form C-998 shall credit the construction Work Order(s) with Cost Element 78 and Account 421-0104, using the classification block(s) labeled "TO GENERAL ACCOUNTING (Cr)," and "Advanced Payment" shall be marked thereon. The completed form shall be forwarded to Finance - Asset Accounting Section. The Districts can then commence construction activities, when appropriate.

Adjustments against the amount collected are to be made according to Form C-1623, "Agreement." To make a refund to the "Requestor" for the amount in excess of the actual cost plus tax, Form C-403 "Request for Cash Voucher," Exhibit D, is prepared and forwarded to the Asset Accounting Section. The notation "Final Statement" shall be included on Form C-403.

Refer to Section 5 on how to collect additional monies.

Upon completion of the Work Order, the District shall forward the original

executed Form C-1623 with a copy of Form C-998 to Corporate Planning and General Services - Vital Records Section in accordance with applicable Supply Chain processes. If an adjustment was made then attach Form C-403 or C-7-1 "Invoice," as appropriate.

4.3.2 Negotiation

Once a negotiated letter agreement is signed and a lump sum payment check is received by the District, construction activities can commence with Work Order approval.

Upon receipt of payment, the District shall complete Form C-998, "Notice of Receipt of Payment for Miscellaneous Accounts Receivable," Exhibit C. The payment and completed form shall be sent to the Asset Accounting Section for processing.

NOTE: Form C-998 shall credit the construction Work Order(s) with Cost Element Code 78 and Account 421-0104 using the classification block(s) labeled "TO GENERAL ACCOUNTING (Cr)" and "Advance Payment" shall be marked thereon.

Adjustments against the amount collected are to be made according to the letter agreement. To make a refund for the amount in excess of the actual cost plus tax, Form C-403 "Request for Cash Voucher," Exhibit D, is prepared and forwarded to the Asset Accounting Section. The notation "Final Statement" shall be included on the Form C-403.

Refer to Section 5 on how to collect additional monies.

4.3.3 Letter of Commitment

Upon approval of the Work Orders and receipt of the letter of commitment, construction activities can commence.

Upon completion of the project, the Work Order Completion Report shall be processed promptly and the invoice prepared and submitted in accordance with Section 5.

Asset Accounting, if requested, can furnish the District with the partial or final billing detail; or the District can request the information directly from EDP-Operation by Form CS 1-516, "Search Controls for Preliminary Listing," Exhibit

E.

5. INVOICING (BILLING)

Whenever an initial billing is to be made or when additional monies are to be requested, either Form C-7-1, or C-7-1A, "Invoice," Exhibit F, is used.

Form C-7-1 or C-7-1A, when submitted for billing, shall not have the "Remit Payment To" address altered. Payment shall be remitted directly to Cash Management to assure correct posting credit.

If a reimbursement payment is received by the District, it shall be deposited locally to Account 143-9-2 (District Number) and be reflected on the Daily Cash Report, Exhibit G. The District shall also send the "Invoice" stubs to Finance - Accounts Receivable to assure the reconciliation of Account 143-9-2.

The invoice numbers shall consist of three (3) parts. The first part shall be the year designator, i.e. 90 for year 1990. The second part shall be the District designation, i.e. 1300 for Central District, 2200 for Pittsburgh District, etc. The third part shall be a District sequential number, starting with 1 each new-year. The remaining portions of the invoice shall be completed with available information.

The District shall forward the original and two (2) copies of the invoice to the party requesting the relocation, along with the billing detail and any other explanation. The District shall retain a copy. The remaining two (2) copies (one being the pre-punched copy) shall be forwarded, along with Form C-2695 "Journal Voucher Sub," Exhibit H, to Finance - Asset Accounting Section. If the invoice for reimbursement is just a partial billing with additional monies to be billed later, it should be so noted on Form C-2695 (i.e.; Partial Billing - Additional amount(s) to be billed later). Likewise, if it is the only billing which will be made, even if it is not for the entire amount of the Work Order, the form should have the notation "Final Bill," (see Exhibit H).

6. STATUS OF REIMBURSABLE WORK ORDERS

To monitor the status of reimbursable Work Orders which are in service for six (6) months and for which a "Final Billing" has not been rendered, Asset Accounting shall perform the following functions:

a. Prior to the last work day of each month, submit a memorandum (Exhibit I, along with Form PD7985-0 [Exhibit J] to the district Plant Manager/Director of Plant Operations (COS) with a copy to the Vice President of Engineering.

b. Insure that a response was submitted to the Asset Accounting Section by the 20th day of the following month.

c. Review responses received (by the applicable Asset Accounting Manager) for reasonableness. Questionable responses will be referred back to the District Plant Manager/ Director of Plant Operations (COS) for immediate clarification. If no response is received by the 20th of the month or the response received in unacceptable, a second copy of PD7985-O, Exhibit J, along with the response or a no response notation will be sent to the District Manager, the appropriate Company President and Vice President-Engineering for their review and action as required.

7. REIMBURSEMENT ACCOUNTING

General Accounting will publish a monthly report of Account Receivables that reflects the status of invoices against Account 143-9-2, Exhibit K. Distribution of this report will be to:

a. Company Presidents

b. Engineering - Vice President

c. District Managers [Vice President of Operations (COS)]

d. Finance - Credit/Collections Section

If payment in full is not received within 90 days of billing, Finance - Credit/Collection Section shall, after consultation with the District and Law Department, take appropriate action. Asset Accounting Section and the District Manager [Vice President of Operations (COS)] shall be advised in writing of any uncollectible amount by the Credit/Collections Section. Asset Accounting will then make the appropriate journal entry, attach the explanation and forward to reverse the uncollectible amount.

8. AID-IN-CONSTRUCTION

Federal tax law requires that any reimbursement to a utility for the relocation of its facilities be considered aid-in-construction and be subject to taxation, if such reimbursement was made as a prerequisite to or as an inducement to providing of gas service by the utility. Questions on taxability should be directed to Finance - Director of Taxes and Risk Management.

The reimbursement shall be classified as taxable or nontaxable. The taxable status shall be indicated on Form C-2695, “Journal Voucher Sub,” Exhibit H, so that Finance - Asset Accounting Section can classify the reimbursement correctly. The taxable status shall be indicated whether or not a gross up, as indicated in the next paragraph, to recover the tax from the customer is required.

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 7 of 21

Only in Commonwealth of Virginia, where the cost of the tax is not currently recovered through the rate base, shall the reimbursement be grossed up to recover the cost of the tax from the customer. The amount of the gross up is calculated by multiplying the Total Estimate by an Income Tax Factor obtained from GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs." The tax collected is classified to account 421-0104, but is not reflected in the Work Order estimate.

9. TAX REFUND

Only in Commonwealth of Virginia does the following apply: When under Form C-1623 or a letter agreement a refund is made for the amount in excess of the actual cost, a proportionate amount of tax shall also be returned.

The amount of tax to be refunded is calculated by multiplying the refund amount (amount collected before tax gross up minus actual cost) by an income tax factor (refer to GS 2810.030(CG) "Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs").

On Form C-403 enter Account 421-0105 for the tax portion.

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 8 of 21

EXHIBIT A

FORM C 1434 CSD (5-85)

JOB NO. _____ (C.E., G. & L. ONLY)

REQUEST FOR SERVICE
TO CIVIL ENGINEERING, GRAPHIC AND/OR LAND SECTION

DATE ISSUED _____

MAP NO. _____

STATE	CO. BILLED	GEN. LEDGER	BUDGET	LOCATION	WORK ORDER NO.	C.E.

COMPANY _____ DEPT. _____ DIST. _____ DIV. _____ AREA _____

SURVEY _____ RAILROAD CROSSING PERMIT _____

EASEMENT OR R/W _____ STREAM CROSSING PERMIT _____

HIGHWAY PERMIT _____ OTHER _____ (DESCRIPTION)

ACQUIRE SITE _____ EXISTING AGREEMENT NUMBER _____

PROJECT LOCATION _____

PROJECT DESCRIPTION _____

CONSTRUCTION WILL START _____

FOR PROJECT DETAILS CONTACT: _____ AT _____ (LOCATION)

REQUESTED BY _____

REMARKS _____

NOTE: ATTACH WORK ORDER COPY OR SKETCH

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 9 of 21

EXHIBIT B

FORM C 1623 CSC (12-86)

Contract No: _____

AGREEMENT

THIS AGREEMENT, made this _____ day of _____, 19____, by and between Columbia Gas of _____ having an office and place of business at 200 Civic Center Drive, Columbus, Ohio 43215, hereinafter referred to as "COLUMBIA".

A
N
D

_____ of _____

_____, hereinafter referred to as "REQUESTOR".

WITNESSETH:

WHEREAS, Columbia owns and operates a _____ inch gas pipeline, located on _____, in _____; and
(City, Township, County, etc. as required)

WHEREAS, Requestor wishes to have said pipeline relocated in order to permit certain construction in the vicinity of said pipeline, and Columbia is willing to relocate said pipeline subject to the conditions set forth below.

NOW, THEREFORE, in consideration of the mutual covenants and promises contained herein, and the parties hereby intending to be legally bound, they do hereby promise and agree as follows:

1. Requestor agrees to pay 100 percent of the actual cost of the relocation.

2. Requestor agrees to deposit the sum of _____ with Columbia, which sum is an estimated cost of relocating Columbia's pipeline. If Requestor decides to cancel or postpone indefinitely the contemplated construction project, Requestor agrees to reimburse Columbia for all costs expended or obligated at the time of the cancellation or indefinite postponement, including costs which may have to be expended to restore the premises to their original condition, said amount to be deducted from the deposit.

3. Upon written execution of this agreement by Columbia and the receipt of said sum of _____ from Requestor, Columbia agrees to begin plans to relocate said pipeline. Columbia will physically relocate said pipeline as mutually agreed to when all necessary rights of way have been secured and all material is available.

4. Upon completion of said relocation, Columbia shall, within a reasonable time, submit to Requestor a statement showing the actual cost thereof. If the actual cost of said relocation is more than the amount of the deposit, Requestor shall promptly pay the excess over the amount deposited to Columbia. If the actual cost is less than the amount of the deposit, Columbia shall promptly return to Requestor the excess of the deposit.

5. It is understood and agreed between the Parties hereto that this project will not be commenced until such time as such relocation will not impair the operations of Columbia in its service of gas to its customers.

6. Requestor relieves Company from any responsibility for any damage which may occur because of Company's construction of that section of pipeline covered hereunder.

WITNESS the due execution of this Agreement the day and year aforesaid.

WITNESS:

_____

WITNESS:

_____

REQUESTOR:

_____

_____

_____

_____

_____

COLUMBIA GAS OF _____, INC.

_____
(Authorized Signature)

_____
(Title)

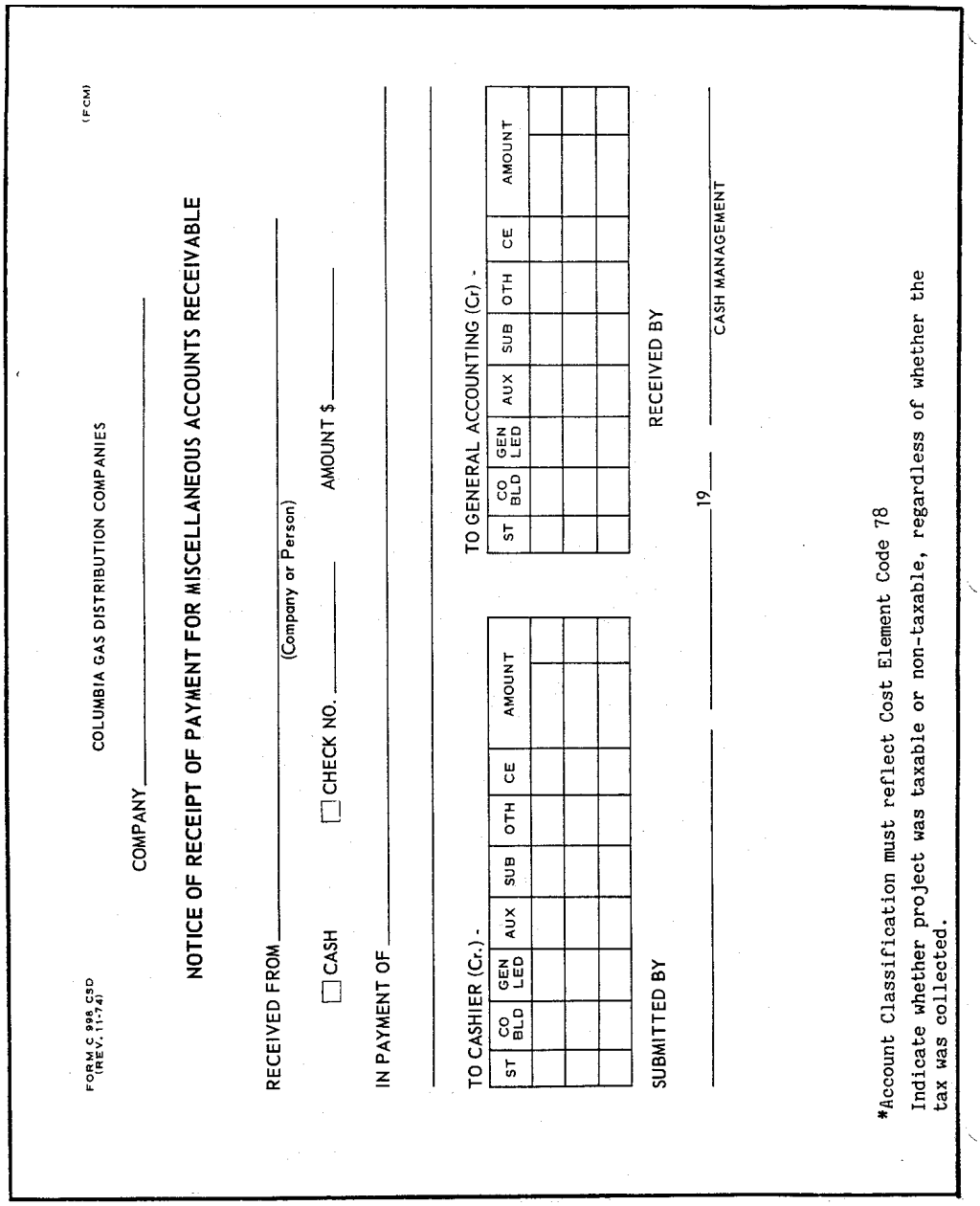
MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 10 of 21

EXHIBIT C



FORM C 998 CSD (REV. 11-74) (FCM)

COLUMBIA GAS DISTRIBUTION COMPANIES

COMPANY _____

NOTICE OF RECEIPT OF PAYMENT FOR MISCELLANEOUS ACCOUNTS RECEIVABLE

RECEIVED FROM _____ (Company or Person)

☐ CASH ☐ CHECK NO. _____ AMOUNT $ _____

IN PAYMENT OF _____

TO CASHIER (Cr.) -

ST	CO BLD	GEN LED	AUX	SUB	OTH	CE	AMOUNT

TO GENERAL ACCOUNTING (Cr.) -

ST	CO BLD	GEN LED	AUX	SUB	OTH	CE	AMOUNT

SUBMITTED BY _____

RECEIVED BY _____

19___ _____ CASH MANAGEMENT

*Account Classification must reflect Cost Element Code 78
Indicate whether project was taxable or non-taxable, regardless of whether the tax was collected.

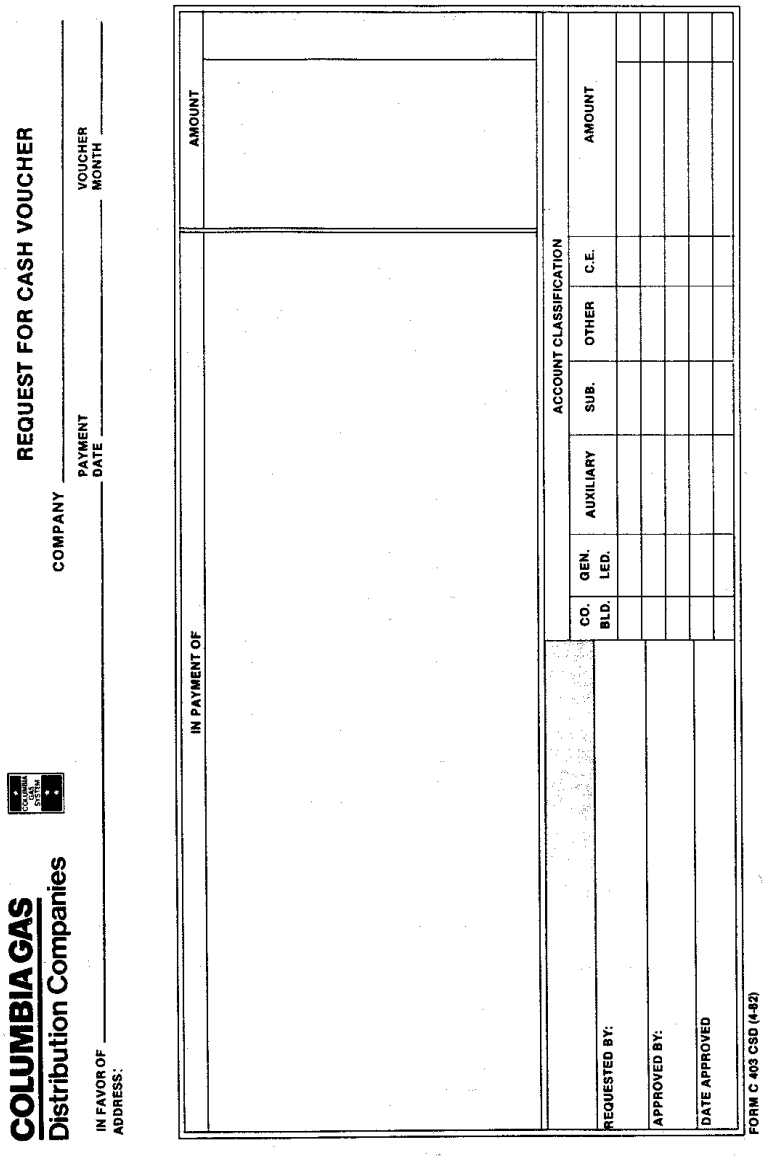
MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 11 of 21

EXHIBIT D



. Account Classification must reflect Cost Element Code 78

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 12 of 21

EXHIBIT E

FORM CS 1-516 CSD

COLUMBIA GAS SYSTEM
PLANT ACCOUNTING SYSTEM
SEARCH CONTROLS FOR PRELIMINARY LISTING

COMPANY		ZONE	GENERAL LEDGER			BUDGET				LOCATION				WORK ORDER			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

SUBMITTED BY:	DATE SUBMITTED:	RETURN TO:	DEPARTMENT
	/ /		

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 13 of 21

EXHIBIT F

COLUMBIA GAS
Distribution Companies

REMIT PAYMENT TO:

CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

DATE

CUSTOMER'S ORDER

PAYABLE UPON RECEIPT

IN ACCOUNT WITH

REMIT PAYMENT TO:

CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

INVOICE NO.

VOUCHER NO.

REFERENCE

IN ACCOUNT WITH

AMOUNT $

PLEASE RETURN THIS COUPON WITH YOUR REMITTANCE

FORM C 7-1 CSD (9-82)

COLUMBIA GAS
of Ohio

REMIT PAYMENT TO:

COLUMBIA GAS OF OHIO, INC.
CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

DATE

CUSTOMER'S ORDER

PAYABLE UPON RECEIPT

IN ACCOUNT WITH

REMIT PAYMENT TO:

COLUMBIA GAS OF OHIO, INC.
CASH MANAGEMENT SECTION
P. O. BOX 117
COLUMBUS, OHIO 43216-0117

INVOICE NO.

VOUCHER NO.

REFERENCE

IN ACCOUNT WITH

AMOUNT $

PLEASE RETURN THIS COUPON WITH YOUR REMITTANCE

FORM C 7-1A CSD (9-82)

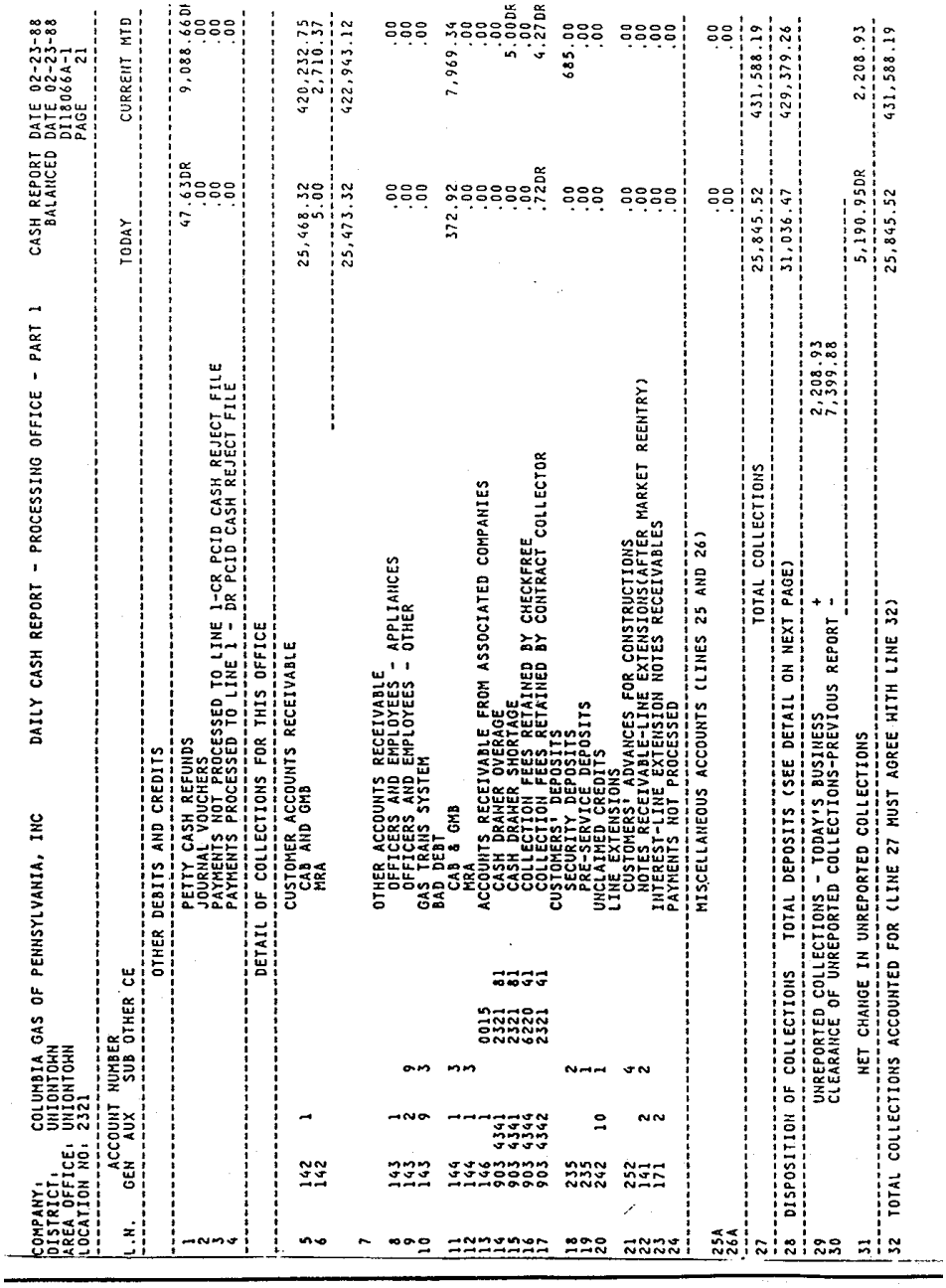
MiSource

Distribution Operations

Gas Standard

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 14 of 21

EXHIBIT G



COMPANY: COLUMBIA GAS OF PENNSYLVANIA, INC DAILY CASH REPORT - PROCESSING OFFICE - PART 1 CASH REPORT DATE 02-23-88
DISTRICT: UNIONTOWN BALANCED DATE 02-23-88
AREA OFFICE: UNIONTOWN DI18066A-1
LOCATION NO: 2321 PAGE 21

L.N.	ACCOUNT NUMBER GEN	AUX	SUB	OTHER CE		TODAY	CURRENT MTD
					OTHER DEBITS AND CREDITS		
1					PETTY CASH REFUNDS	47.63DR	9,088.66DR
2					JOURNAL VOUCHERS	.00	.00
3					PAYMENTS NOT PROCESSED TO LINE 1-CR PCID CASH REJECT FILE	.00	.00
4					PAYMENTS PROCESSED TO LINE 1 - DR PCID CASH REJECT FILE	.00	.00
					DETAIL OF COLLECTIONS FOR THIS OFFICE		
					CUSTOMER ACCOUNTS RECEIVABLE		
5	142	1			CAB AND GMB	25,468.32	420,232.75
6	142				MRA	5.00	2,710.37
7						25,473.32	422,943.12
					OTHER ACCOUNTS RECEIVABLE		
8	143	1			OFFICERS AND EMPLOYEES - APPLIANCES	.00	.00
9	143	2	9		OFFICERS AND EMPLOYEES - OTHER	.00	.00
10	143	9	3		GAS TRANS SYSTEM	.00	.00
					BAD DEBT		
11	144	1	3		CAB & GMB	372.92	7,969.34
12	144	1	3		MRA	.00	.00
13	146	1		0015	ACCOUNTS RECEIVABLE FROM ASSOCIATED COMPANIES	.00	.00
14	903	4341		2321 81	CASH DRAWER OVERAGE	.00	.00
15	903	4341		2321 81	CASH DRAWER SHORTAGE	.00	5.00DR
16	903	4344		6220 41	COLLECTION FEES RETAINED BY CHECKFREE	.00	.00
17	903	4342		2321 41	COLLECTION FEES RETAINED BY CONTRACT COLLECTOR	.72DR	4.27DR
					CUSTOMERS' DEPOSITS		
18	235		2		SECURITY DEPOSITS	.00	685.00
19	235		1		PRE-SERVICE DEPOSITS	.00	.00
20	242	10	1		UNCLAIMED CREDITS	.00	.00
					LINE EXTENSIONS		
21	252		4		CUSTOMERS' ADVANCES FOR CONSTRUCTIONS	.00	.00
22	141	2	2		NOTES RECEIVABLE-LINE EXTENSIONS(AFTER MARKET REENTRY)	.00	.00
23	171	2			INTEREST-LINE EXTENSION NOTES RECEIVABLES	.00	.00
24					PAYMENTS NOT PROCESSED	.00	.00
					MISCELLANEOUS ACCOUNTS (LINES 25 AND 26)		
25A						.00	.00
26A						.00	.00
27					TOTAL COLLECTIONS	25,845.52	431,588.19
28	DISPOSITION OF COLLECTIONS TOTAL DEPOSITS (SEE DETAIL ON NEXT PAGE)					31,036.47	429,379.26
29	UNREPORTED COLLECTIONS - TODAY'S BUSINESS +					2,208.93	
30	CLEARANCE OF UNREPORTED COLLECTIONS-PREVIOUS REPORT -					7,399.88	
31	NET CHANGE IN UNREPORTED COLLECTIONS					5,190.95DR	2,208.93
32	TOTAL COLLECTIONS ACCOUNTED FOR (LINE 27 MUST AGREE WITH LINE 32)					25,845.52	431,588.19

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 15 of 21

EXHIBIT H
(1 of 4)

Instructions for completing Form C 2695, "Journal Voucher Sub."

The following are keyed to Form C 2695, page 2 of this Exhibit for items to be entered on "Voucher".

Key	Item	Description
1	Company	Self-explanatory
2	Month of --	Enter month and year submitted to Plant Accounting
3	Account Classification	Enter on line one Account No. 143-9-2-(District Number). Skip one line and enter only the 107 Work Order Number(s) associated with the billing.
4	Debit	Enter against Account No. 143-9-2-(District Number) the total of the amount being billed. If more than one Work Order is involved, total the debit.
5	Credit	Enter against the Work Order(s) the amount being billed. If more than one Work Order is involved, total the credits. Note: Credit total must equal Debit.
6	"Project"	Provide project name for identification and list all related Work Orders.
7	"Billing Status"	Indicate "Final or Partial".
8	"Tax Status"	Indicate whether "Taxable or Non-Taxable," regardless of whether the tax was collected.
9	"Statement"	Enter the following appropriately completed: To record the transfer to Accounts Receivable of charges to a reimbursable Work Order. These charges represent the costs incurred by Columbia Gas of _____, Inc. to relocate their facilities at the request of _____. See attached detail.
10	Compiled By	Indicate name of person compiling voucher.
11	Verified By	Indicate name of person verifying voucher.
12	Approved By	Indicate name of person verifying voucher. To be signed by District Plant Manager/Director of Plant Operations (COS).

Note: Page 3 of 4 reflects a completed Form C 2695 for a single 107/108 Work Order project whereas Page 4 of 4 reflects a multiple 107/108 Work Order project.

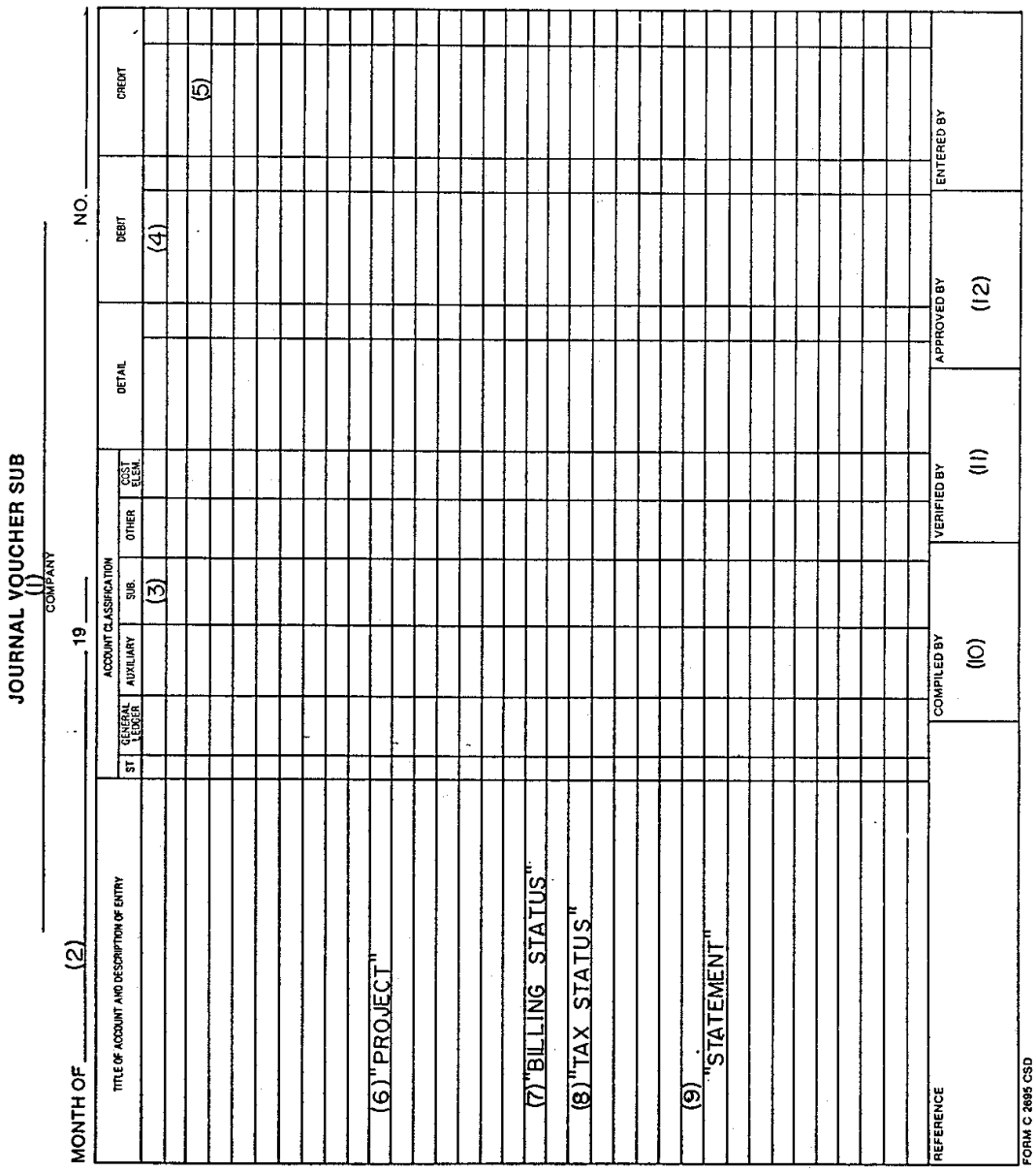
MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 16 of 21

EXHIBIT H
(2 of 4)



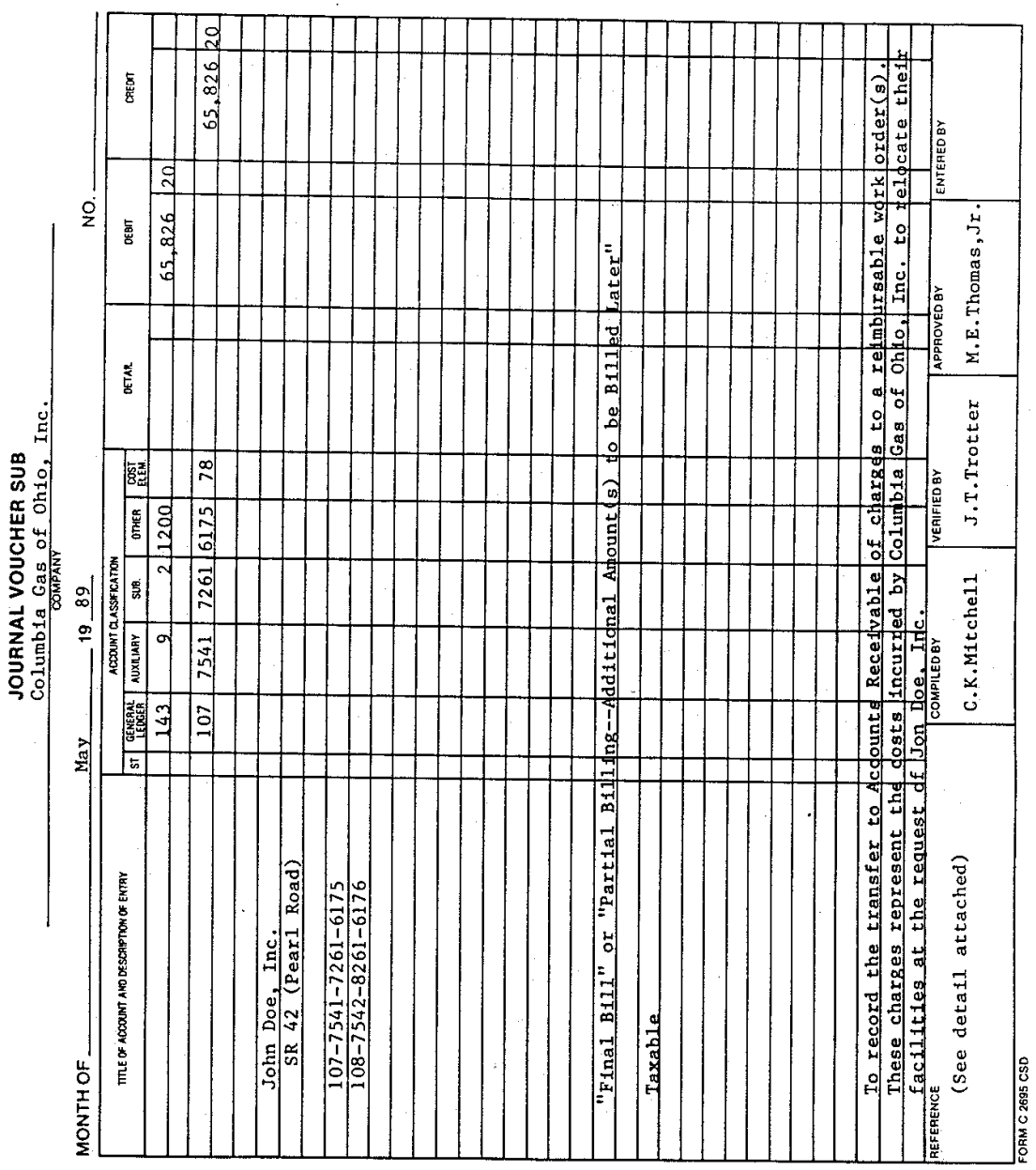
MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 17 of 21

EXHIBIT H
(3 of 4)



JOURNAL VOUCHER SUB
Columbia Gas of Ohio, Inc.
COMPANY

MONTH OF May 19 89 NO.

TITLE OF ACCOUNT AND DESCRIPTION OF ENTRY	ST	ACCOUNT CLASSIFICATION: GENERAL LEDGER	AUXILIARY	SUB.	OTHER	COST ELEM.	DETAIL	DEBIT	CREDIT
		143	9	2	1200			65,826 20	
		107	7541	7261	6175	78			65,826 20
John Doe, Inc.									
SR 42 (Pearl Road)									
107-7541-7261-6175									
108-7542-8261-6176									
"Final Bill" or "Partial Billing--Additional Amount(s) to be Billed Later"									
Taxable									
To record the transfer to Accounts Receivable of charges to a reimbursable work order(s). These charges represent the costs incurred by Columbia Gas of Ohio, Inc. to relocate their facilities at the request of Jon Doe, Inc.									

REFERENCE: (See detail attached)
COMPILED BY: C.K.Mitchell
VERIFIED BY: J.T.Trotter
APPROVED BY: M.E.Thomas,Jr.
ENTERED BY:

FORM C 2695 CSD

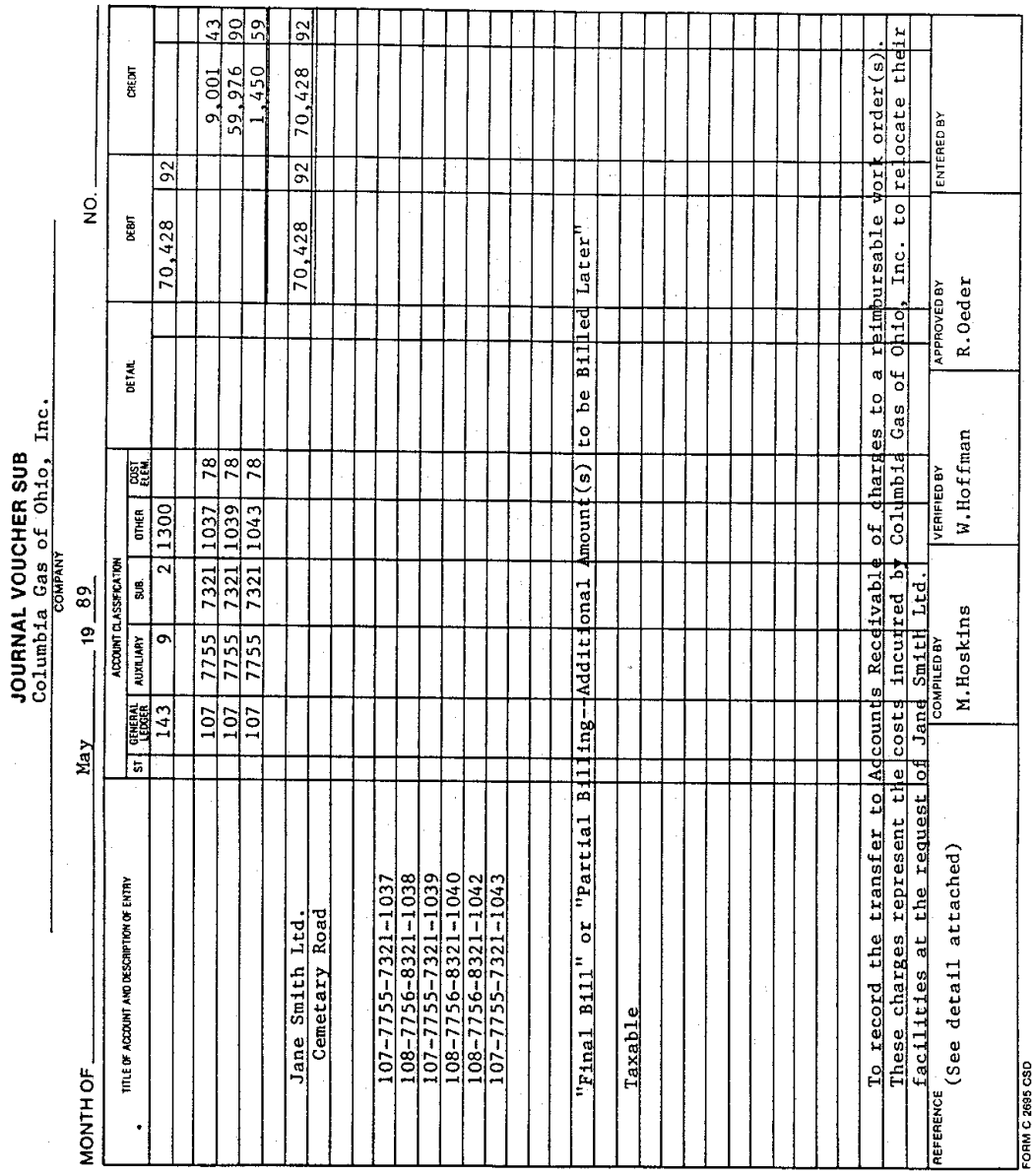
MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 18 of 21

EXHIBIT H
(4 of 4)



JOURNAL VOUCHER SUB
Columbia Gas of Ohio, Inc.
COMPANY

MONTH OF May 19 89 NO.

TITLE OF ACCOUNT AND DESCRIPTION OF ENTRY	ST	ACCOUNT CLASSIFICATION GENERAL LEDGER	AUXILIARY	SUB.	OTHER	COST ELEM.	DETAIL	DEBIT		CREDIT	
		143	9	2	1300			70,428	92		
		107	7755	7321	1037	78				9,001	43
		107	7755	7321	1039	78				59,976	90
		107	7755	7321	1043	78				1,450	59
								70,428	92	70,428	92
Jane Smith Ltd.											
Cemetary Road											
107-7755-7321-1037											
108-7756-8321-1038											
107-7755-7321-1039											
108-7756-8321-1040											
108-7756-8321-1042											
107-7755-7321-1043											
"Final Bill" or "Partial Billing--Additional Amount(s) to be Billed Later"											
Taxable											
To record the transfer to Accounts Receivable of charges to a reimbursable work order(s). These charges represent the costs incurred by Columbia Gas of Ohio, Inc. to relocate their facilities at the request of Jane Smith Ltd.											

REFERENCE (See detail attached)

COMPILED BY M.Hoskins

VERIFIED BY W.Hoffman

APPROVED BY R.Oeder

ENTERED BY

FORM C 2695 CSD

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 19 of 21

EXHIBIT I

COLUMBIA GAS System

Office Memorandum

To: District Plant Manager Date:

From: Director - Asset Accounting

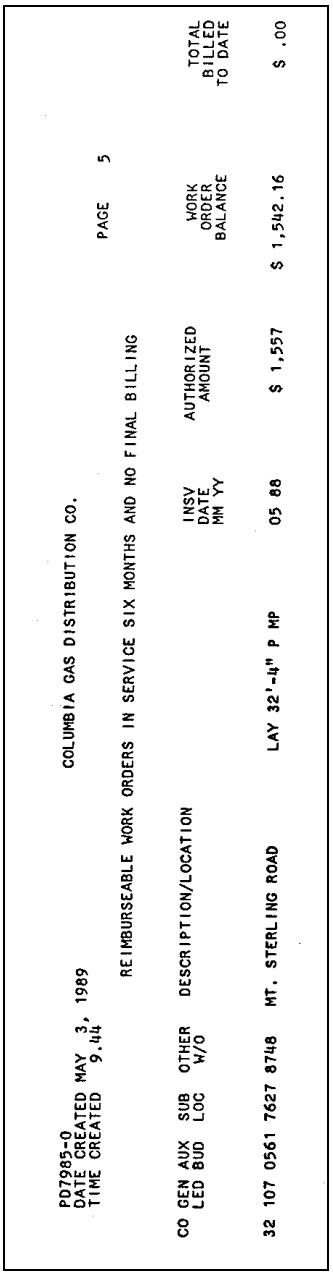
Subject: Status of Reimbursable Work Orders

Attached is a listing entitled "Reimbursable Work Orders In Service Six Months and No Final Billing." Prudent management requires that billings be rendered for payment in a timely manner. Please advise me by the 20th of _____ why these Work Orders in service six months or more have not been final billed.

GS 2850.012(CG) requires that you respond to this request for billing status by the above date and that the reason for the delayed billing be properly explained. Should Asset Accounting not receive an adequate response in a timely manner, the procedure further requires that follow-up requests be directed to the attention of the District Manager and Company President.

Attachment

EXHIBIT J



PD7985-O COLUMBIA GAS DISTRIBUTION CO. PAGE 5
DATE CREATED MAY 3, 1989
TIME CREATED 9.44

REIMBURSEABLE WORK ORDERS IN SERVICE SIX MONTHS AND NO FINAL BILLING

CO	GEN LED	AUX BUD	SUB LOC	OTHER W/O	DESCRIPTION/LOCATION	INSV DATE MM YY	AUTHORIZED AMOUNT	WORK ORDER BALANCE	TOTAL BILLED TO DATE
32	107	0561	7627	8748	MT. STERLING ROAD LAY 32'-4" P MP	05 88	$ 1,557	$ 1,542.16	$ .00

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/16/1991	**Relocation Projects - Others**	Standard Number: **GS 2850.012(CG)** P&P 626-2
Supersedes: N/A		Page 21 of 21

EXHIBIT K

COLUMBIA GAS OF PENNSYLVANIA, INC.

OTHER ACCOUNTS RECEIVABLE - District Reimburseable Billings AS OF
(Account 143-9-2)

NAME - Work OrderNumber	CURRENT Billed amount	NON - CURRENT PRIOR MONTH	NON - CURRENT TWO MONTHS TO 1 YEAR	NON - CURRENT OVER 1 YEAR	TOTAL
Patton-Ferguson Joint Authority	$ -	$ -	$ 1,589.26 (B)	$ -	1,589.26
Work Order Number					
Pennsylvania Dept. of Transportation	-	-	32,606.75 (B)	-	32,606.75
Work Order Number					
W. W. Developers	-	-	772.87 (B)	-	772.87
Work Order Number					
Total	$ -	$ -	$34,968.88	$ -	$34,968.88

Balance Account 143-9-2 $34,968.88

(A) Paid
(B) Under Credit Dept. review
(C) Under Law Dept. review
(D) Under District Office review
(E) Partial payment received
(F) To be corrected
(G) Payment pending insurance company decision
(H) 2% above prime rate at Morgan Guaranty & Trust Co. adjusted monthly
(I) Collection Agency
(J) Under Motor Transportation Review
(K) Settlement Date 6/30/89

WPS/FIN:GA-0007

NiSource

Gas Standard

Distribution Operations

Effective Date: 10/18/1991	**Relocation of Service Lines per Customer Request**	Standard Number: **GS 2850.014(CG)** P&P 626-3
Supersedes: N/A		Page 1 of 7

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL INFORMATION

This procedure applies when a customer requests that the service line be relocated.

The customer shall be advised that reimbursement will be required prior to any relocation. The customer shall be advised that any “on premise” customer owned piping changes shall be at the customer's expense.

2. REIMBURSEMENT PROCESS

2.1 Estimating Cost

The Company representative shall determine the cost of relocating the Company service line by either making a detailed estimate for each service line or using a standard rate established by the Operating Area or District. (Refer to Exhibit A.) The estimated cost, where applicable, shall include all the labor, material, equipment, applicable overheads, paving, aid-in-construction tax (for non-governmental customer) and any other costs necessary to:

a. install the new service line,

b. abandon the old service line,

c. fabricate a meter and/or regulator setting (as may be the case with some commercial and industrial customers),

d. inspect and test the customer's piping changes.

2.2 Combined Plant and Service Statements

When relocation of a service line involves both Plant and Service work, only one statement shall be presented to the customer. The combined statement will eliminate

possible customer confusion and complaints. The customer shall not be billed for charges in excess of the estimate.

2.3 Contacting Customer and Receiving Payment

The customer shall be notified by letter (Exhibit B) in duplicate, concerning the cost of relocating the service line. If the customer decides to proceed, he shall sign the bottom portion of the original letter to indicate agreement and attach a check or money order. The letter upon being signed and returned shall be retained in the District.

The Area Manager, upon receiving payment, shall notify Plant and Service as applicable, by the following forms: Plant - Form C 2641, “Service Line Order”; Service - Form C 2652, “DIS Order.”

2.4 Processing Payment

The Area Manager shall complete the form letter (Exhibit C). The payment and form letter shall be sent to Finance - Asset Accounting Section for processing.

2.5 Account Classification

Reimbursement for cost incurred in relocating Company service lines under three inches is to be credited to Account 107 as follows:

			Other						
Gen			Cat. 1		Cat. 2		Cat. 3		
Led.	Aux.	Sub.	Co.	Contr.	Co.	Contr.	Co.	Contr.	Code
107	565	Loc #	31	32	231	232	331	332	78

Three-inch and larger service line installations require an individual reimbursable Work Order.

The Service Department account to be credited, if applicable, is 879-3413-(blank)-Location Number. Changes to this account are not subject to the Aid-in-Construction tax.

The Aid-in-Construction tax collected per Section 5 shall be credited to 421-0104.

Effective Date: 10/18/1991	**Relocation of Service Lines per Customer Request**	Standard Number: **GS 2850.014(CG)** P&P 626-3
Supersedes: N/A		Page 3 of 7

3. ACCOUNTING FOR TANGIBLE LABOR AND MATERIAL

All labor, material, equipment and other costs incurred shall be accounted for by charging to the appropriate accounts reflected in Section 2.5.

4. CUSTOMER SERVICE LINES AND METER SETTINGS

The customer is responsible for the cost of all “on premise” customer owned piping changes. The Company shall furnish as needed the domestic meter set assembly, meter and regulator(s), at no charge to the customer. When a Company fabricated meter and/or regulator setting for commercial and industrial customers is required, the cost for such fabrication shall be included in the combined Plant and Service statement.

5. AID-IN-CONSTRUCTION TAX

Only in Commonwealth of Virginia, where the cost of the tax is not currently recovered through rate base, shall the reimbursement be grossed up to recover the cost of the tax from the customer. The amount of the gross up is calculated by multiplying the Total Estimate by an Income Tax Factor obtained from GS 2810.030(CG) “Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs.” The tax collected is classified to account 421-0104 but is not reflected in the Work Order estimate.

Federal tax law requires that any reimbursement for the relocation of facilities of a utility be considered Aid-in-Construction and be subject to taxation if such reimbursement was made as a prerequisite to or as an inducement to the providing of gas service by the utility. Questions on taxability should be directed to Finance - Director of Taxes and Risk Management.

The reimbursement shall be classified as taxable or nontaxable so that Finance - Asset Accounting Section can classify the reimbursement correctly, see Exhibit C. The taxable status shall be indicated whether or not a gross up to recover the tax from the customer is required.

MiSource

Gas Standard

Distribution Operations

Effective Date: 10/18/1991	**Relocation of Service Lines per Customer Request**	Standard Number: **GS 2850.014(CG)** P&P 626-3
Supersedes: N/A		Page 4 of 7

EXHIBIT A
(1 of 2)

Cost Estimate Method
for

Relocating a Company Service Line

Based on COS May, 1991 Rates	SAMPLE ESTIMATE	
LABOR RATE (INCLUDING OVERHEADS)		
Plant: $22.59/hr. x 8 hrs. x 2 men =	$ 361.44	
Service: $22.59/hr. x 1 hr. x 1 man =	$ 22.59*	
		$ 384.03
AUTO TRANSPORTATION		
Plant: 1 truck @ $3.85/hr. x 8 hrs. =	$ 30.80	
Service: 1 truck @ $3.85/hr x 1 hr. =	$ 3.85*	
		$ 34.65
GENERAL TOOLS		
1 trencher @ $2.85/hr x 8 hrs. =		$ 22.80
TOTAL MATERIAL		
Service Tee	$ 7.25	
Plastic Pipe (60' x $0.08/ft)	$ 4.80	
Service Riser	$ 18.00	
		$ 30.05
STORES EXPENSE		
$30.05 x 12% =		$ 3.61
PAVING (Contractor)		
$8/sq. ft. x 20 sq. ft. =		$ 160.00
	Sub Total	$ 635.14
CONSTRUCTION OVERHEADS		
$635.14 x 10.576% =		$ 67.17
	Sub Total	$ 702.31

MiSource

Gas Standard

Distribution Operations

Effective Date: 10/18/1991	**Relocation of Service Lines per Customer Request**	Standard Number: **GS 2850.014(CG)** P&P 626-3
Supersedes: N/A		Page 5 of 7

EXHIBIT A
(2 of 2)

ALLOWANCE FOR FUNDS DURING CONSTRUCTION (15 Days)

$702.31 x 0.00% =		$ 0.00
	Sub Total	$ 702.31

TAX FOR AID-IN-CONSTRUCTION

$702.31 - 22.59 - 3.85 x 28.95% =		$ 195.66
	TOTAL	$ 897.97

NOTE: Method of estimating shall not be attached to the customer's bill. Refer to GS 2810.030(CG) “Hourly Rates and Accrual and Overhead Percentages Used in Calculating Costs” for current rates and percentages.

* Charged to an operating account; therefore, not subject to the Aid-in Construction tax.

MiSource

Gas Standard

Distribution Operations

Effective Date: 10/18/1991	**Relocation of Service Lines per Customer Request**	Standard Number: **GS 2850.014(CG)** P&P 626-3
Supersedes: N/A		Page 6 of 7

EXHIBIT B

Date

Mr. Name
Address
City, State, Zip Code

Dear Mr. Name:

We have considered your request to relocate the Company service line at Address, City. The cost of the relocation work for which you will be responsible, if you elect to proceed, will be $897.97.

We remind you that this cost does not include installation or relocation of any of your house lines.

It is estimated that the gas company's relocation work will be completed, weather permitting, within one week after the receipt of your payment.

If you elect to proceed, in accordance with the above, please sign the bottom portion of this letter and return in the enclosed envelope along with your check made payable to Commonwealth Gas Services, Inc. for $897.97. This signed letter and check becomes an agreement between you and the gas company upon receipt by the Company.

Yours truly,

Area Manager

WPS/bw

To: Commonwealth Gas Services, Inc.

I, _____ hereby agree to the terms specified above.

Customer Signature

_____ Date

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Gas Standard

Distribution Operations

Effective Date: 10/18/1991	**Relocation of Service Lines per Customer Request**	Standard Number: **GS 2850.014(CG)** P&P 626-3
Supersedes: N/A		Page 7 of 7

EXHIBIT C

COLUMBIA GAS System

Office Memorandum

To: Manager - Asset Account Section Date:

From: Area Manager

Subject: Contribution in Aid-in-Construction - Service Line

A contribution in aid-in-construction was collected in the amount of ____, which includes a base contribution of ____ and a tax portion of ____, (check attached) from:

Name: _____

Address:

City, State, Zip:

This contribution is (taxable) (non-taxable).

Please Credit;

Base Contribution to:

Work Order: 107-XXX-XXXX-XXX-78 in amount of $ _____

Service Dept: 879-3413 - ( ) - Loc # in amount of $ _____

Taxing District: XXXXXXX

Tax Portion of $____ to:

Other Income: 421-0104-0000-0000

Attachment (Payment Check

MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 1 of 13

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

The operation of a distribution system requires knowledge of the system operating pressure, in particular peak day pressures. This procedure provides guidelines for a systematic method of acquiring and reporting peak day pressure information.

The peak day pressure reporting system is necessary to:

a. Inform Engineering - Facilities Planning of existing or potential pressure problem areas.

b. Provide pressure information when evaluating a piping system for replacement, relocation, betterment, and load acquisition studies.

c. Establish a ready reference in case of emergency conditions involving pressure or supply.

d. Provide data for justifying betterment projects.

2. RESPONSIBILITY

The Operations Engineer shall be responsible for:

a. acquiring and reporting peak day pressure information.

b. reviewing field pressure reports and comparing peak day outlet pressures to the MAOP's.

c. investigating suspected pressure problem areas.

d. specifying the location(s) of supplemental pressure monitoring points.

e. annually reviewing and updating peak day maps to insure that MAOP, piping and other facility or pressure changes are incorporated.

Plant and Service Supervisors as well as Area Managers are responsible for providing assistance to obtain the required recording charts and pressure checks.

3. PEAK DAY PRESSURE MAPS

Peak day pressure maps shall be developed for all measured areas and may reflect unmeasured communities or systems of 50 customers or more.

Peak day pressure maps shall contain the following information:

a. All District Regulator and Point of Delivery Stations.

   1. Number

   2. Name of Key stations

   3. Space for recording inlet and outlet pressures

b. MP and HP system piping (including "D" systems). Note: Skeletonized IP piping system shall be included if supplying a LP District Regulator.

c. Name and number of TCO or non-affiliate company supply line(s).

d. Date, temperature and wind conditions.

e. MAOP of each regulator outlet.

The peak day pressure maps should reflect the following:

a. Operating map number(s).

b. GMB station name and number.

c. Pipe size and footage, whenever practical.

4. SKETCH PREPARATION

Whenever practical, piping systems shall be skeletonized onto 8-½" x 11" sheets. Exhibits A through E reflect various type piping systems. As Engineering - Facilities Planning "Market Area Maps" become available they should be utilized. A left side margin for binding and lower right-hand corner title block similar to the Facilities Planning "Market Area Map" title block shall be included.

Other convenient size sheets may be used that allow for a binding margin (left side) and title block (lower right-hand corner). Larger sheets shall be capable of being folded to 8-1/2" by 11" (an allowance must be made for the binding margin).

5. COMPILING PRESSURE MAPS

Annually, Engineering - Facilities Planning will determine the CDC peak delivery day for each Company and request a bound set of peak day pressure maps, Exhibit F.

The Operations Engineer shall establish a system for requesting pressure maps and recording charts. Exhibit G reflects a method to accomplish this and may be varied to incorporate District operating practices.

If the Operations Engineer can show that the peak day for a particular city, town, etc. did not correspond to the Company's peak day, supple-mental maps shall be furnished. A brief explanation shall accompany the maps.

Peak day pressure maps, when submitted to Facilities Planning, should be color coded to reflect the following conditions during the peak hour:

a. inlet and/or outlet pressures at all regulators with recording pressure gauges (suggested color code red).

b. set outlet pressures of all regulators without recording pressure gauges (suggested color code blue).

c. non-recorded inlet pressure, if known (suggested color code green).

Recognized pressure problems along with a proposed solution should be submitted as part of the peak day pressure report, Exhibit H.

6. RECORDING CHARTS

Recording charts received by the Operations Engineer will be reviewed for the purpose of:

a. Observing the manner and determining the cause for which pressure-fall-off occurs at the inlet/outlet of a station or at a suspected low point.

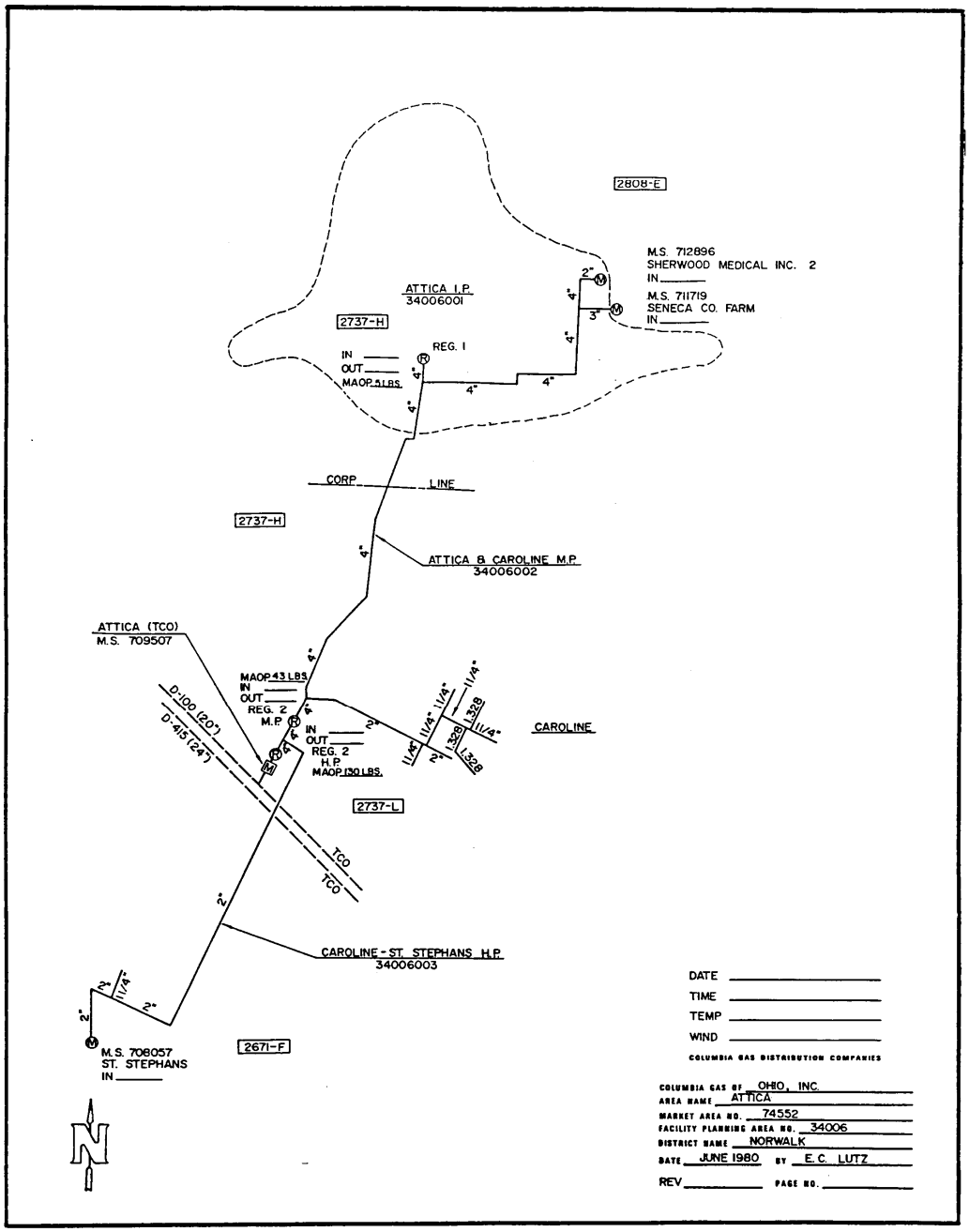
b. Noting the operating characteristics of a regulator, which may be indicative of a regulator sizing problem.

MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 4 of 13

EXHIBIT A

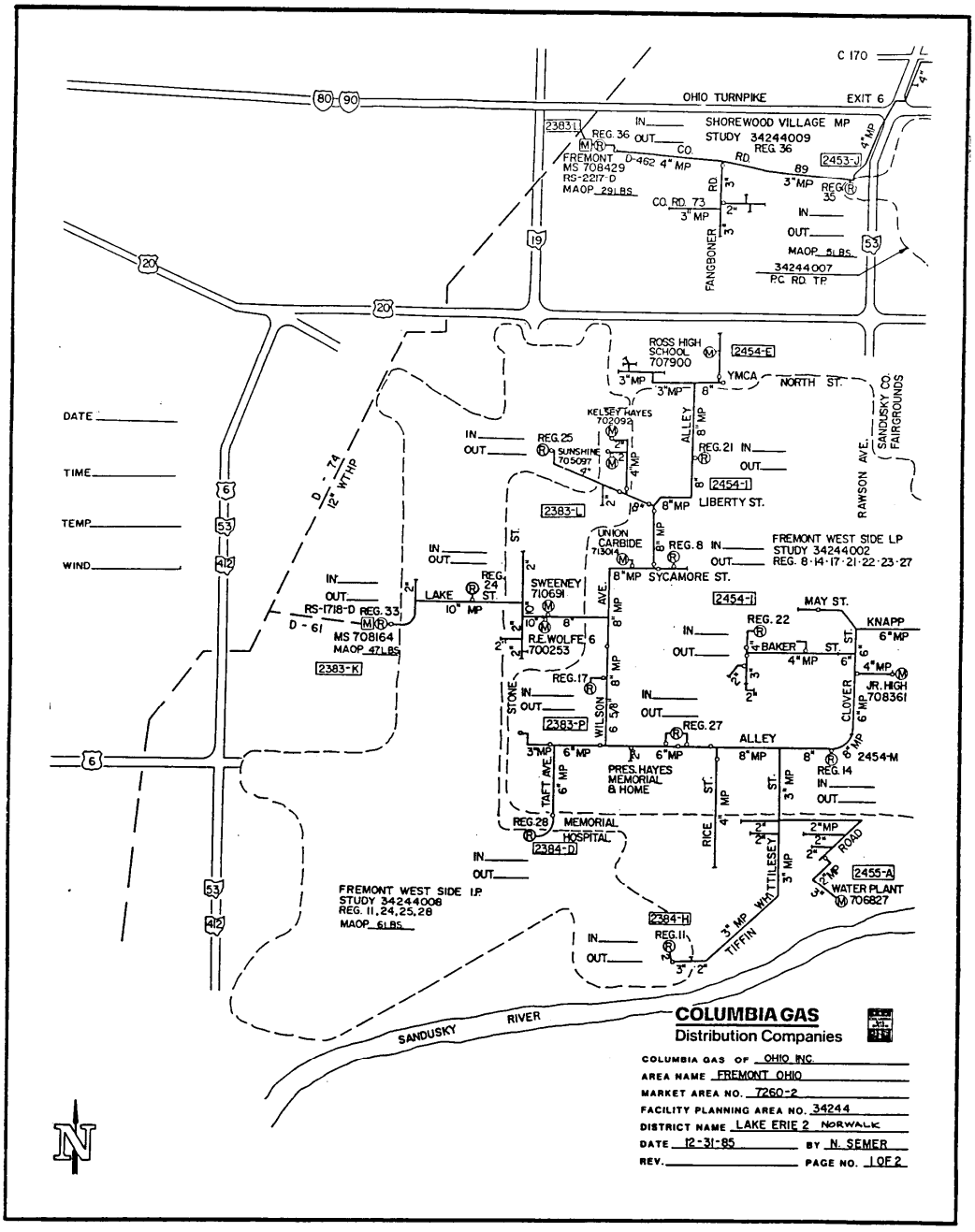


MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 5 of 13

EXHIBIT B
(1 of 2)

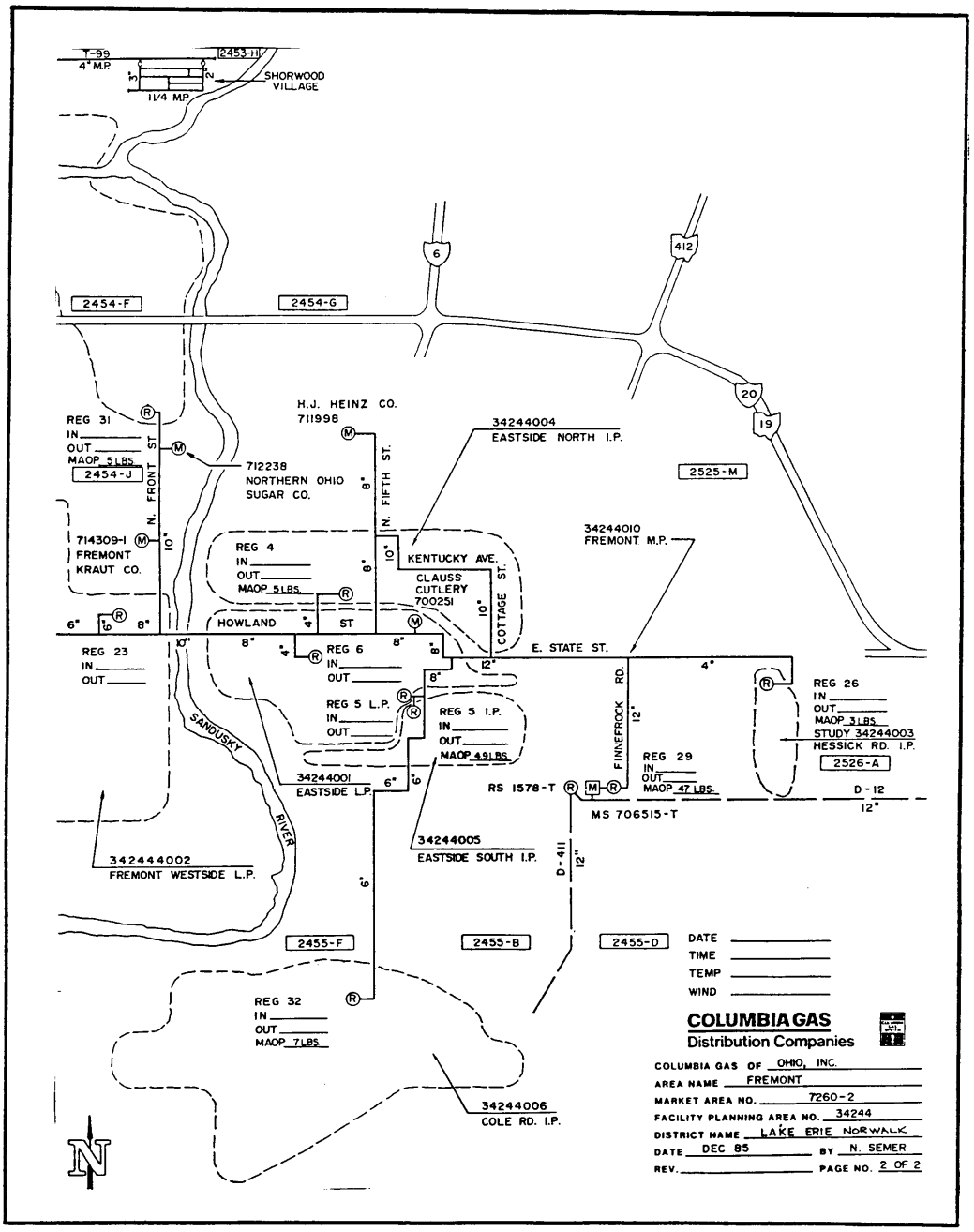


MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 6 of 13

EXHIBIT B
(2 of 2)

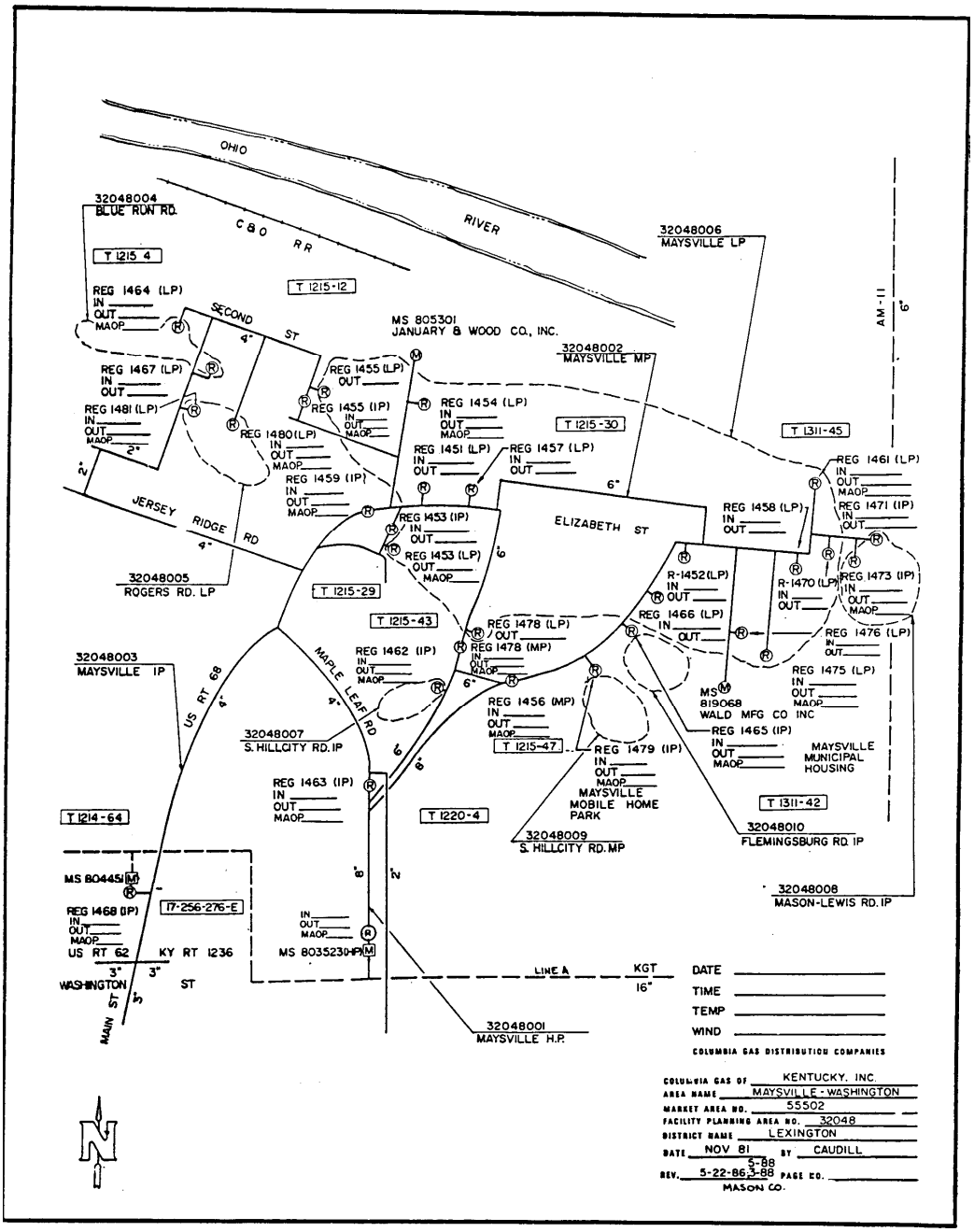


MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 7 of 13

EXHIBIT C

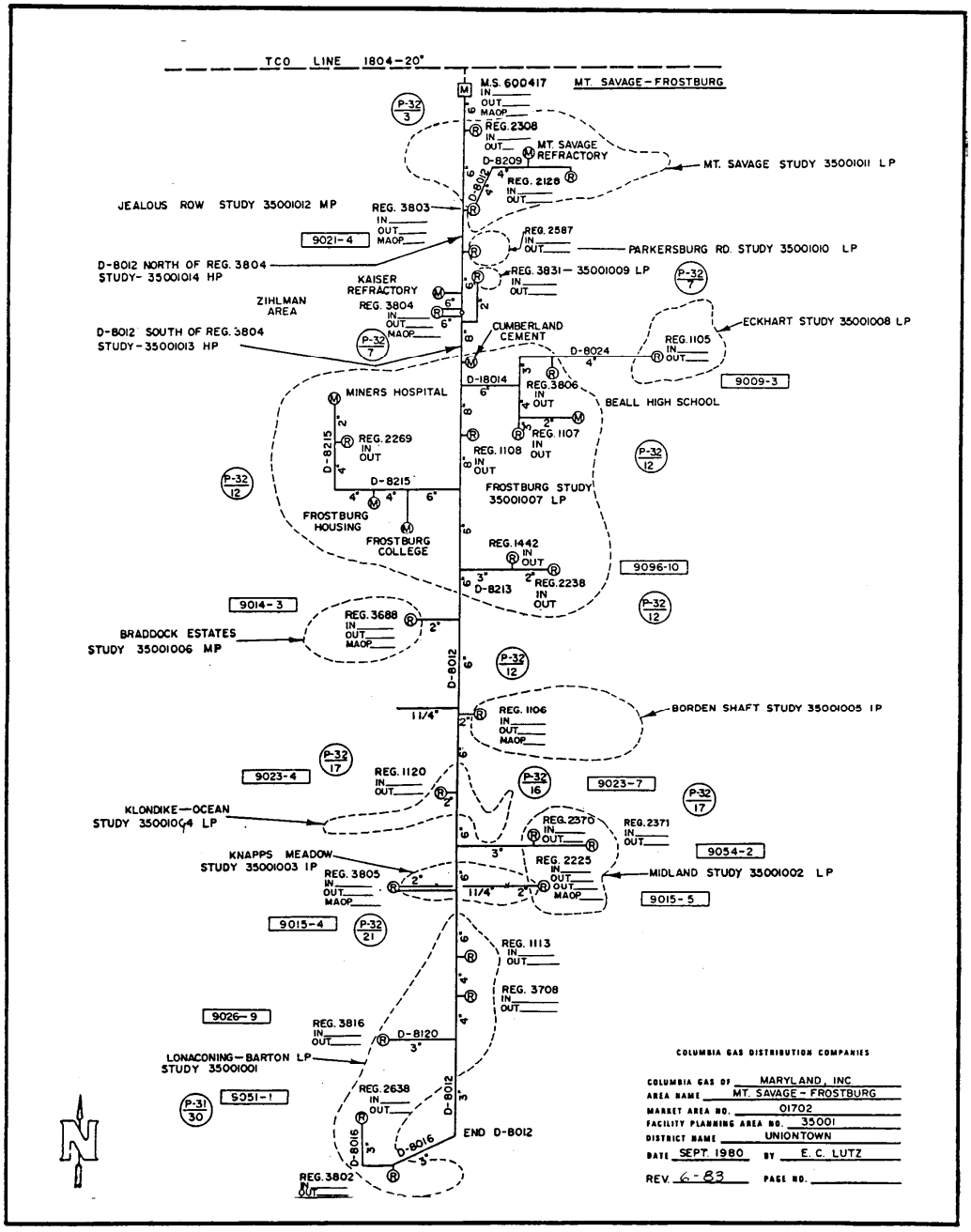


MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 8 of 13

EXHIBIT D

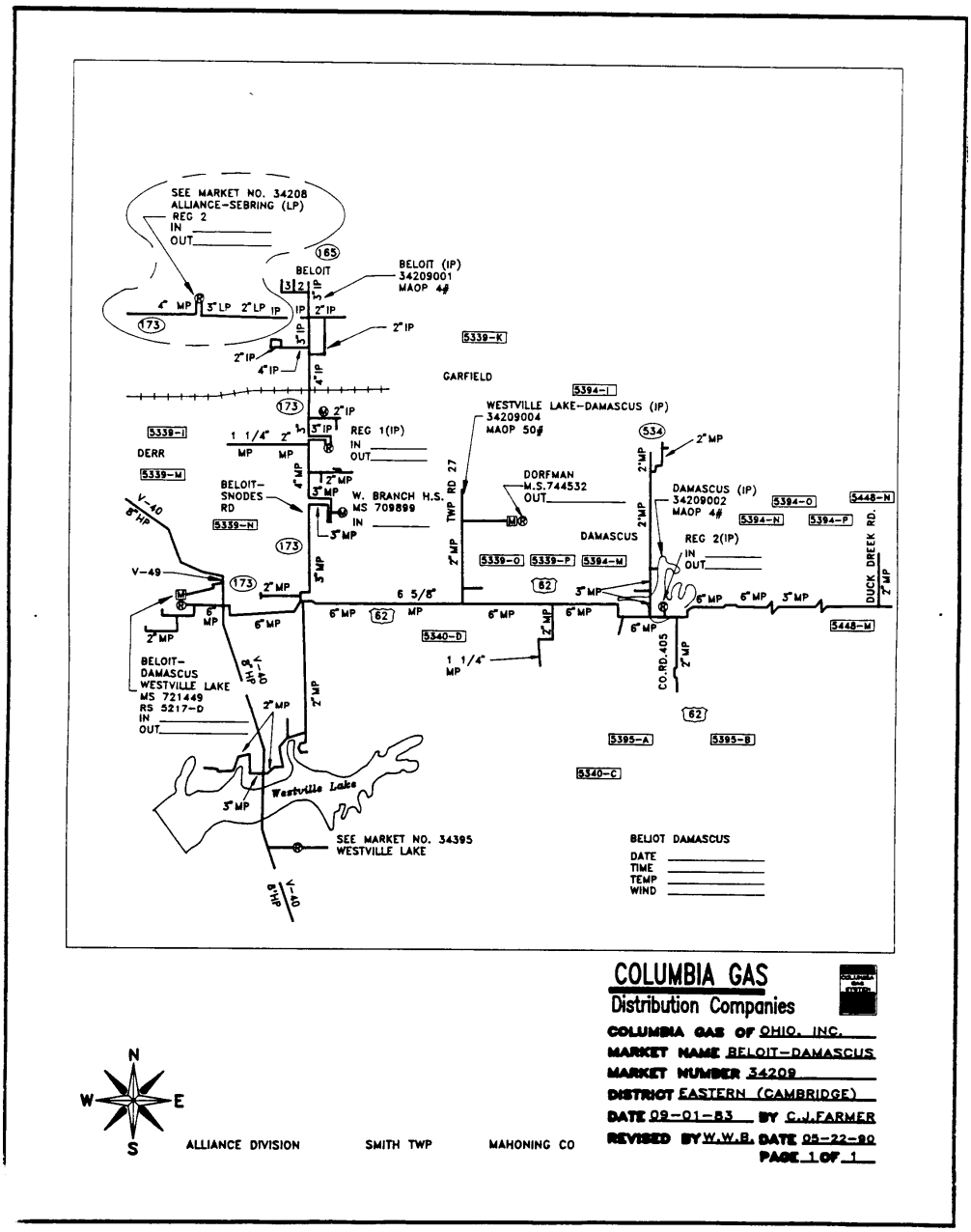


MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 9 of 13

EXHIBIT E



MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 10 of 13

EXHIBIT F

Office Memorandum

COLUMBIA GAS System

To: District Plant Managers
Director of Plant Operations (COS)

Date: January 28, 2011

From: Manager - Facilities Planning and Design

Subject: 19_-_ Peak Day Dates for Peak Day Map Preparation

Based upon the maximum daily deliveries established by TCO billing information and delivery data from other suppliers, CDC has been advised that the Peak Day date for each CDC Company for this past winter is as follows:

Company	Day
CMD	12/22/_
CPA	12/18/_
COS	12/22/_
CKY	12/22/
COH	12/21/_

Please compile and submit your Peak Day pressure maps in booklet form on this basis. We recognize that these dates reflect maximum deliveries on a state-wide basis and that you may have experienced a different Peak Day in your region of the state. In which case, your Peak Day report should reflect the pressures you experienced on the regional Peak Day.

You should utilize Facilities Planning "Market Maps" whenever possible since this allows the Peak Day pressures for an entire market to be looked at all at once.

We also strongly urge you to note any piping corrections in red on Facilities Planning "Market Maps" so these may be brought up to date. It would also be appreciated if any unusually low operating pressure or problem areas be addressed in a cover memo accompanying the Peak Day maps. (See Distribution Operations Gas Standard, GS 2870.010(CG), "Peak Day Pressure Reporting.")

MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 11 of 13

EXHIBIT G
(1 of 2)

Office Memorandum

COLUMBIA GAS System

To: Division (Area) Supervisors Date: January 28, 2011

From: Operations Engineer

Subject: Regulator Pressures

It is that time of year at which we should examine our regulator outlet pressures and adjust them to meet peak hourly requirements.

You are being sent corrected pressure maps of each town in your area to consolidate the peak hour requirements.

Please send completed maps and pressure charts for the first work day that the temperature dips to 15^{o} F above zero or less. Thereafter, the maps and charts will be requested when the temperature falls below 5^{o} F, as has been past practice.

Use red pencil to indicate pressures from recording charts and blue pencil for those from spot checks. (Please indicate time of spot checks.)

Suspected low points in your area are indicated on the attached. Please arrange to have recording gauges installed at the points indicated. When sufficient information is obtained, we will discuss the various problems for possible improvements.

Excessive pressure will have to be justified. This should be done by a portable recording gauge reading at the suspected low points of the system and shown on the pressure map. You may send in the pressure map and recording charts showing the pressure at the low point and the operating pressure at the District Regulators feeding the area in question at any time. Please note the date, temperature and wind condition.

Additional maps will be forwarded on request.

Very truly yours,

Operations Engineer

Attachments

MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 12 of 13

EXHIBIT G
(2 of 2)

ELYRIA DIVISION

199_ - 199_ Heating Season

TOWN	SYSTEM	PRESSURE CHECK AREA
Amherst	I.P.	Place recording gauge in B-Bar-B Mobile Home Park.
Elyria	I.P.	Place recording gauge on Eagle Circle in Pikewood Manor Mobile Home Park.
Lorain	L.P.	Place recording gauge on East 33rd Street, East of Elyria Avenue.

MiSource
Distribution Operations

Gas Standard

Effective Date: 08/02/1991	**Peak Day Pressure Reporting**	Standard Number: **GS 2870.010(CG)** P&P 530-12
Supersedes: N/A		Page 13 of 13

EXHIBIT H

ELYRIA DIVISION

LAKE ERIE DISTRICT

199_ - 199_ Heating Season

TOWN	SYSTEM	PROBLEM AND PROPOSED SOLUTION
Amherst	I.P.	It was necessary to adjust the outlet pressure fed by Regulator Number 14 to maintain adequate inlet pressure (2 psig) to Regulator Numbers 17 and 18. These regulators feed low pressure systems that are known as the B-Bar-B Mobile Home Park. This situation will be alleviated with the conversion of approximately 184 low pressure customers, and the retirement of these District Regulator Stations.
Elyria	I.P.	The 6 pounds outlet pressure that was carried out of Regulator Number 68 was necessary to delivery 1 pound pressure along Eagle Circle in the Pikewood Manor Mobile Home Park. We are presently issuing the necessary Budget 559 Work Order to correct this situation.
Lorain	L.P.	It was necessary to carry over 15" W.C. to hold adequate pressure on East 33rd Street, East of Elyria Avenue. A Budget 559 Work Order is being prepared to correct this low pressure condition. This betterment project is known as Project Number 9 on Network Analysis Study Number XXXXXXXX.

NiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/2014	**Gas Supply Gas Quality Specifications**	Standard Number: **GS 2910.010**
Supersedes: 04/15/2010		Page 1 of 4

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE AGA Report 4A, “Natural Gas Contract Measurement and Quality Clauses”

AGA Research Bulletin 36, “Interchangeability of Other Fuel Gases with Natural Gases”

1. GENERAL

In the absence of overriding tariff specifications, contracts for gas purchased, transported, or exchanged shall conform to the following gas quality specification.

The gas quality specifications in this standard do not supersede specifications in existing or future Company tariffs or contracts. These specifications can be applied in the absences of tariff or contract specifications.

This standard does not apply to sources of internal supply, such as propane-air peak shaving plants.

2. GAS QUALITY

2.1 Specification of Components

The following Table 1 specifies the limits for components found in natural gas. The intent is that all criteria are met.

Table 1 – Natural Gas Component Limits

Component	Limit	Effect
OXYGEN	Reasonable efforts to maintain gas free from oxygen, and shall not exceed 1% by volume	Internal corrosion, odor fade
HYDROGEN SULFIDE	Shall not exceed 1/4 grain per 100 cf of gas	Corrosive, toxic
TOTAL SULFUR	Shall not exceed 20 grains per 100 cf of gas	Corrosive
CARBON DIOXIDE	Shall not exceed 2% by volume	Internal corrosion, combustion
NITROGEN	Shall not exceed 4% by volume	Internal corrosion, combustion
CARBON DIOXIDE & NITROGEN	Combined total shall not exceed 5% by volume	Internal corrosion, combustion
TOXIC HAZARDOUS SUBSTANCES	Company may cease receipt of gas at any time toxic substances or chemicals that the Company deems hazardous and/or unsafe are found in gas or liquid samples.	Hazard to employees, customers, public
DUST, GUM AND SOLID MATTER	Gas shall be free of dust, gum-forming constituents and other solid matter	Operations of equipment
LIQUIDS	Gas shall be free of water and hydrocarbons in liquid form at the temperature and pressure at which the gas is delivered. Additionally, gas shall not contain any hydrocarbons which might condense to free liquids in the pipeline, and shall in no event contain water vapor in excess of 7 pounds per one million cubic feet at standard conditions.	Operations of equipment / system
HEATING VALUE	Shall not be less than 967 Btu's per cubic foot when determined on a dry basis.	Combustion, energy billing

2.2 Temperature

Excessively high or low gas temperature can be detrimental to the piping system and its equipment. High gas temperatures can contribute to steel pipe stress corrosion cracking. It also de-rates the maximum pressures of flanges and components if over 100 degrees F. There is a similar effect on plastic pipe as the temperature used to determine its design pressure is normally 73 degrees F. High temperatures can be generated by compressors or piping exposed to solar radiation.

Cold temperatures cause piping and components to be more brittle and fail from cracking. Temperatures must not be below -20 degrees F for steel pipe and components, and can be as low as -40 degrees F for plastic.

2.3 Interchangeability

Gas Interchangeability is defined as the ability to substitute one gaseous fuel for another in a combustion application without materially changing operational safety, efficiency, or performance, or materially increasing air pollutant emissions.

Interchangeability is described in technically based quantitative measures, such as indices, that have demonstrated broad application to end-uses, and can be applied to either end-users or individual suppliers.

The Utilization Factor (Wobbe Index) is one interchangeability indication of a gas' ability to pass through a burner orifice and generate heat by combustion. The factor is determined by:

$$UF = \frac{HV}{\sqrt{SG}}$$

Where:

UF = Utilization Factor
HV = Heating Value [Btu's / 1,000 cu. ft.]
SG = Specific gravity of the gas (air = 1.0)

The target value for UF is 1,300, and must be within a range of +/- 6%. It is not intended that the gas supply vary by this range, but that a burner can be adjusted for proper combustion if the UF is within the range.

Additionally, a further analysis can be completed for gas interchangeability to check indices of yellow-tipping, flame lift-off, and flash-back. This analysis will compare the substitute gas with the specific reference gas in the system

3. REMEDIATION

The following remedial actions shall be completed by the Leader M&R when gas supplies do not meet the limits in Section 2. At no time will NiSource accept gas with toxic or hazardous substances. These supplies shall be shut off.

1. Call and inform the gas supplier of the situation.
2. Request the gas supplier to remedy the situation.
3. Inform the gas supplier the expectations of the time frame allowed for

remediation. If the situation warrants, the supply may be shut off immediately.

4. Inform the gas supplier that if remediation has not been completed by the allowed time frame, then shut off of the supply will be considered.

5. While the gas supplier attempts to remedy the situation, gather information pertaining to operation issues with the current supply. Involve Field Engineering and local Corrosion personnel to consider operational issues such as: internal corrosion; pressure regulation downstream of supply point; amount of pressure drop before supply reaches customers; heaters at regulator downstream of supply point; and regulator or meter distance downstream of supply point. There may be no operation issues.

6. Determine if the situation is detrimental to pipeline operations, corrosion, measurement operation and regulator operations. Discuss the situation with Operating Center Managers, System O&M Managers, and Field Engineers.

7. Determine if shutting off gas supplies will limit gas supply to NiSource customers.

8. Shut off supplier if supply can be shut off without limiting the supply to NiSource customers and the gas supplier has not remedied the situation.

Increased monitoring of facilities may be required if supply cannot be shut off and the issues have not be resolved.

4. RETURNING SUPPLY TO SERVICE.

When a supplier requests to be turned back on after being shut off due to not meeting the gas quality specification, tests to insure the gas now meets the gas quality specification shall be completed by field personnel with input from local Corrosion personnel and Field Engineering. The cost of the tests if any shall be borne by the supplier.

5. RECORDS

All engineering/operations records of gas analyses and other pertinent information (e.g., interchangeability analyses) shall be retained by the Field Engineering person responsible for the operations location where the gas supply site is located.

All records retained for this standard shall be kept for the life of the Company's system it enters.

MiSource
Distribution Operations

Gas Standard

Effective Date: April 1, 2008	**Alternate Gas Sources Evaluation and Requirements**	Standard Number: **GS 2910.020**
Supercedes: N/A		Page 1 of 5

REFERENCE

AGA Report No. 4A: Natural Gas Contract Measurement and Quality Clauses

AGA NGC+: White Paper on Natural Gas Interchangeability and Non-Combustion End Use

AGA Bulletin #36

1. GENERAL

Non-traditional sources of methane gas for end-use are mainly produced by bacterial breakdown of biomass/biowaste to create “biogas”. This biogas must be conditioned by removing harmful and undesirable components, producing a “biomethane”, before it can be injected into the natural gas system for delivery. The conditioning of non-traditional, alternate gas sources requires safeguards and for the Company to closely monitor the end product prior to it entering the distribution system. The specific source of the biogas might dictate additional measures in monitoring the end-gas quality.

Some sources of biogas include:

1) Landfills – methane gas produced from anaerobic bacteria
2) Manure digester (e.g., dairy farms)
3) Other biomass (e.g., waste water treatment)

2. EVALUATION OF GAS SUPPLY

When the Company is contacted by a site operator to accept an alternate gas source (biomethane), Field Engineering should coordinate the activities to evaluate the source, decide on its acceptance, and complete the installation of a required station.

2.1 Evaluation of Alternate Gas Source

Gas sources considered for new potential supplies shall have an initial gas analysis to determine their acceptability. The source should meet the Company’s gas quality specification. If the source does not completely meet the standard, the company Engineering Manager may decide to accept the gas based on considerations, such as: 1) the effect on the system supply, 2) interchangeability, and 3) customer equipment. In addition, constituents listed in Section 2.3, “Specific Source Considerations” should be checked to ensure that they fall within acceptable limits.

The site operator’s provided gas sample can be reviewed for initial evaluation, but the Company shall acquire its own sample and use its own testing laboratories.

2.2 System Considerations

It is important for the Company's distribution system design to consider the alternate gas source as a supplement to the system. An upset of the biogas supply or conditioning system may trigger safeguards that immediately terminate the supply into the Company's distribution system. Therefore, it should not be considered critical for maintaining service to the customers.

2.2.1 System / Supply Planning

Where practical, the alternate source should enter the Company's system at a point having significant flow to commingle with the natural gas. This strategy will minimize the biomethane's effect on customers' utilization equipment. The resultant gas mixture should be monitored to record the actual heating value based on the contribution of each gas. It follows that end-of-line feeds and systems where the alternate gas source would dominate the flow into it should be avoided, but if they can't, and gas interchangeability should be closely checked.

The Company's Gas System Planning group should be consulted to provide entry point details from modeled simulations. Properties from initial gas samples, such as specific gravity, should be provided to the group to prepare the models.

The Company's system pressure must also be considered as these alternate sources require compression to at least the level of the system. The greater the compression to higher pressures, the more likely it is that increased operation and maintenance work will be required by the site operator, resulting in a less reliable supply.

2.2.2 Customer Supply Sensitivity

When considering receipt of the alternate gas source, the effect of the supply on downstream customers' equipment should be examined. Some utilization equipment, such as boilers and burners for certain processes, can handle changes in gas heating value and specific gravity better than other equipment. For example, typical residential heating equipment may not tolerate diverse gas quality, and the result may be incomplete combustion or flame lifting. Contact should be made with customers having unique equipment/processes to inquire about their equipment's specifications. Processes involving precise heating (e.g., glass factories or paint drying booths) are sensitive to the gas heating value. Also, customers that burn more than a certain amount of natural gas must maintain air-quality permits, which are directly affected by the gas quality.

2.2.3 Interchangeability with System Gas

An important consideration is how the biomethane gas burns in comparison to the normal natural gas in the distribution system, called interchangeability. The two gases must not be so different that their varying mixture would cause problems in end-use equipment. Interchangeability qualities to consider are the index of Wobbe and indices of burner yellow-tipping, lift-off, and flashback (see AGA Bulletin #36).

If the biomethane is not within the interchangeability parameters, the site operator may be required to further remove constituents or to enrich the supply, generally by injecting propane. The site operator's further measures, such as an enrichment process, may prompt additional monitoring to be installed by the site operator, and subsequently checked by the Company.

2.3 Specific Source Considerations

While the alternate gas source operator is required to provide supply that meets the Company's standards, specific sources will have different impacts on the Company's systems in the event of a site's malfunction of equipment safeguards. In addition, there are different types of gas conditioning that affect the ability to remove the undesirable constituents.

2.3.1 Landfills

The normal composition of landfill biogas includes about 45% carbon dioxide (CO_2). Removal of this component is critical to avoid combustion problems and internal steel pipe corrosion. Other known constituents that must be limited are siloxanes, hydrogen sulfide (H_2S), volatile organic compounds (VOCs), the water content (H_2O), nitrogen (N_2), and oxygen (O_2). Other constituents may be present, as indicated by the gas sample analysis. Each of these may require specific investigation and proactive measures.

2.3.2 Dairy Farms

The components of biogas from dairy farms that must be removed are CO_2 (35%), ammonia, H_2S, and high water content. Anaerobic bacteria from the digester could be a component of the end gas if not completely removed. All of these components could be detrimental to a steel piping system and equipment. They could also cause utilization equipment combustion problems and pose health risks.

The biogas composition can widely vary with the biomass feedstock composition. Other ingredients can be added to the digester, such as plant waste, to change the biogas. Other constituents in the biogas can include

copper sulfate and antibiotics from the animal manure.

2.4 Minimum Safeguards

Due to harmful and/or undesirable components in unconditioned biogas, the site operator shall employ certain safeguards to ensure these do not enter the natural gas system. The conditioned biogas must be continuously monitored for these components, and reactionary devices, such as automatic shut-off valves, employed to stop the biogas flow in the event that the conditioning equipment fails to perform adequately.

The Company may also install continuous monitoring equipment, or utilize access to the site operator's monitoring equipment, to determine when an abnormal condition exists at the site. Remotely operated valves can be used by the Company in the event the operator's safeguards fail. In addition, the Company may install corrosion monitoring, such as coupons or probes, for corrosive agents that may not be identified by typical gas quality monitoring equipment.

If manually monitoring the site, the frequency should initially be on a quarterly basis until experience shows that less frequent monitoring is justified.

2.5 Acceptance of Supply Source

Upon review of the Company's initial gas sample analysis and specific source and system conditions, a decision will be made on the ability to accept the supply.

If it is decided to accept the alternate gas source, the details of the decision shall be documented and Energy Supply Services shall be notified to execute a contract with the site operator. The site operator shall also be notified of the decision. Specific equipment, such as a chromatograph or gravitometer, may be required to constantly record the biomethane and/or commingled gas properties.

If the supply cannot be accepted, then the decision shall be documented and the site operator notified as to the reasons.

The performance of the alternate gas source operation shall be monitored to ensure compliance. Any injection of the raw biogas into the Company's system will result in immediate termination of the supply. Frequent disturbances shall prompt a complete review of the site's operations to ensure safeguards are performing as required, and to obtain assurance from the site operator that problems are promptly corrected.

3. RECORDS

All engineering/operations records of gas analyses, information supplied by the alternate gas source operator, other pertinent information (e.g., interchangeability analyses, system

modeling, or customer equipment needs), and all related communications concerning the decision on whether to accept the supply shall be retained by the Field Engineering person administering the site.

All records retained for this standard shall be kept for the duration of the source entering the Company's system.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2950.900(CG)** P&P 680-1
Supersedes: N/A		Page 1 of 15

Companies Affected:

☐ NIPSCO	☑ CGV	☐ CMD
☐ NIFL	☑ CKY	☑ COH
☐ Kokomo Gas	☐ CMA	☑ CPA

REFERENCE None

1. SCOPE

This procedure explains the use of Liquefied Petroleum Gas (LPG) Peak Shaving Plant Operating forms to provide the Columbia Gas Distribution Companies (CDC) with a uniform method of reporting monthly propane inventories and usage.

Forms used are as follows:

A. Monthly Liquefied Petroleum Gas Statistics - Form C-1514
B. Liquefied Petroleum Gas Statistics - Form C-1515
C. Propane Plant Production and Statistics - Form C-1516

These forms are to be used by all CDC Peak Shaving Plants and will be explained in detail on following pages

2. PROCEDURE FOR USE OF FORM C-1514 "MONTHLY LIQUEFIED PETROLEUM GAS STATISTICS"(EXHIBIT A)

2.1 Purpose:

The purpose of Form C-1514 is to provide up to date monthly information on the amount of propane used and in storage distribution-owned propane peak shaving plant. This information is used to inform management of current status of all peak shaving plants, and to provide the Finance Department with current inventories and monthly propane usage figures for the monthly financial report as summarized on Form C-1516 by Engineering & Planning.

2.2 Procedure:

Form C-1514 "Monthly Liquefied Petroleum Gas Statistics" must be compiled by the field and be completed by the last working day of the month. The original of this report must be received by the Engineering and Planning Department in the General Office no later than the 5th day of the following month. Examples of the completed form are shown in the attachments. (Exhibit A)

3. PROCEDURE FOR USE OF FORM C-1515 "LIQUEFIED PETROLEUM GAS STATISTICS":

3.1 Purpose:

Form C-1515 "Liquefied Petroleum Gas Statistics" is the daily operating report that is the basis for the information on the monthly C-1515 report. (Exhibit B)

This form is a daily operating report used to monitor propane tank inventories. This should be filled in any time the plant operates, flares gas or is test run. This form will also be completed on the last working day of each month (whether or not the plant operated) as a monthly inventory check to determine propane stock adjustments.

3.2 Procedure:

This form will be completed for each day, as stated above, on any day the plant operates, flares gas, is test run, receives or ships out propane. All propane tank inventories will be reported to the nearest 100 gallons. Plant operators will determine the amount of propane in each tank and make a temperature correction to determine the gallons at 60ºF. However, when operators report the inventory, the figure will be recorded to the nearest 100 gallons.

Example: 23,019 gallons will be reported as 23,000 gallons
23,049 gallons will be reported as 23,000 gallons
23,050 gallons will be reported as 23,100 gallons
23,950 gallons will be reported as 24,000 gallons

This procedure will apply to all quantities reported on Lines 1 through 7 on the daily operating report. When propane is loaded or unloaded, it must be recorded on the back of Form C-1514 exactly as shown on the shipping notice. However, when the total is shown in Line 2, this figure should be reported to the nearest 100 gallons. The exact recording of individual railroad cars and trucks is required so that the Finance Department can account for all propane purchases and transfers. However, operators should be careful in making the calculations of gallons at 60º F in order to insure the accuracy of the tank inventories. All operators will use an average specific gravity of .510 when selecting temperature correction factors from the backside of Form C-1515 and actual temperatures from individual tank thermometers.

Completed examples of C-1515 showing a winter month's operation are attached. Months when no operations (including test runs of shipments) occur require only a stock inventory adjustment be made on the last working day of the month.

This form will only be maintained for the propane plant file and need not be submitted to the General Office.

4. PROCEDURE FOR USE OF FORM C-1516 "MONTHLY LIQUEFIED PETROLEUM GAS STATISTICS" (EXHIBIT C)

4.1 Purpose:

This form is prepared by the Engineering and Planning Department in the General Office. This form is completed monthly and is used by the General Office to summarize operational data taken directly from Form C-1514 for each CDC propane peak shaving plant. Form C-1516 is submitted to the Finance Department by the 10th of each month for inventory accounting. This summary form is also submitted during the winter months (December, January, February, March and April) to the Charleston and Pittsburgh Dispatching Offices and to key General Office Management personnel.

4.2 Procedure:

Form C-1516 is prepared in typewritten form by the Engineering and Planning Department and utilizes the individual monthly operating data from each propane plant as submitted by the field on form C-1514. The General Office then summarizes the individual propane plant operation by State. The actual propane volumes in storage are compared against the maximum amount of propane that can be stored at each plant and a determination is made whether or not additional propane must be ordered. The bottom of the form is used to make any special notes needed to clarify operating information. Five copies of Form C-1516 are then submitted to General Accounting, Finance Department by the 10th of the month for inventory accounting.

The original of this form is retained on file in the Engineering and Planning Department. An example of this form is shown in Exhibit C.

NiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
Supersedes: N/A		Page 4 of 15

EXHIBIT A
(1 of 2)

FORM C (DSP) 1514 CSD

COLUMBIA GAS DISTRIBUTION COMPANIES

MONTHLY LIQUEFIED PETROLEUM GAS STATISTICS

IDENTIFICATION	PROPANE PLANT: BINGHAMTON	MONTH: FEB	YEAR: 1976	SHEET: 1 of 1	
	MONTH BEGINS (Time, Date): 8 A.M. 2 1 76	MONTH ENDS (Time, Date): 8 A.M. 3 1 76		GALLONS (In 100s)	
L. P. GAS STATISTICS — TO BE ACCOUNTED FOR	ON HAND – BEGINNING OF MONTH (Previous Month's Report, Line (I))			(A)	719 500
	RECEIVED THIS MONTH (This Report – Reverse Side)			(B)	125 000
	TOTAL BEGINNING INVENTORY AND RECEIVED (A) + (B)			(C)	844 500
SHIPPED OUT	THIS MONTH (This Report – Reverse Side)			(D)	NONE

USED (L. P. Gas-Air Production This Month)

DATE Mo.	DATE Da.	ACTUAL PRODUCTION OF PROPANE-AIR GAS Mcf	EQUIVALENT NATURAL GAS REPLACED Mcf	L.P. GAS USED TO REPLACE NATURAL GAS Gallons (In 100s)
2	1	1411	1961	22 400
2	2	2772	3832	44 000
2	6	5810	8160	93 900
2	9	3740	5150	59 300
TOTALS		13733	19103 (E)	219 600

	TOTAL L. P. GAS USED TO REPLACE NATURAL GAS	(E)	219 600

TEST RUNS BURNED AT FLARE (In 100s of gallons)

MO.	DA.	MO.	DA.	MO.	DA.	MO.	DA.	MO.	DA.
2	27								
GALLONS 1,100		GALLONS		GALLONS		GALLONS		GALLONS	

	TOTAL BURNED AT FLARE	(F)	1 100
STOCK DEPLETIONS	SHIPPED, USED AND BURNED (D) + (E) + (F)	(G)	220 700
BOOK BALANCE	NET (C) – (G)	(H)	623 800
PHYSICAL INVENTORY	ON HAND – END OF MONTH ((B) on Form C (DSP) 1515 CSD	(I)	628 000
STOCK ADJUSTMENT	☑ STOCK GAIN: (I) is larger than (H); (J) is a + ☐ STOCK LOSS: (I) is smaller than (H); (J) is a –	(J)	+ 4 200

TOTAL GALLONS PLANT STORAGE (In 100's of Gallons) 840,000	NATURAL EQUIV. AVAILABLE MCF (I x .0871) = 54,600	% FILLED – END OF MONTH 75%
COMPILED BY: PLANT OPERATOR	CHECKED BY (Field): PLANT SUPERVISOR	APPROVED BY (General Office): R.T. BURROWS

ORIGINAL AND 2 COPIES to General Office by 5th of following month; COPY to Propane Plant file.

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
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EXHIBIT A
(2 of 2)

FORM C (DSP) 1514 C5D

PROPANE RECEIVED OR SHIPPED

PROPANE PLANT: BINGHAMTON | MONTH: FEB | YEAR: 1976 | SHEET: 1 of 1

DATE Mo.	DATE Da.	RAILROAD CAR OR TRUCK NUMBER	INVOICED GALLONS @ 60° F. Received	INVOICED GALLONS @ 60° F. Shipped	REPORTED TO GENERAL OFFICE IN 100s OF GALLONS Received	REPORTED TO GENERAL OFFICE IN 100s OF GALLONS Shipped
2	10	GATX 96864	31 270		31 300	
2	10	NATX 32052	31 136		31 100	
2	26	GATX 91195	31 982		32 000	
2	26	NATX 34064	30 592		30 600	
		TOTAL			125 000	

PROPANE PLANT STATISTICS

NAME	STATE	NUMBER AND SIZE OF TANKS	TOTAL TANK CAPACITY W. C. GALLONS	MAX. WINTER STORAGE CAP. @ 88% – GAL.	MAX. SUMMER STORAGE CAP. @ 85% – GAL.	MAX. DAILY CAPACITY NAT.–GAS EQUIV. MMCF	NORMAL BTU OUTPUT PROPANE AIR	NATURAL GAS BTU	MAX. DISC. PRESSURE PSIG	AVAILABLE NAT. GAS. EQUIV. (MCF) WHEN FULL 88%
BINGHAMTON	N.Y.	28-30,000	840,000	713,000	689,000	11.2	1,450	1,020	150	62.0
JOHNSON CITY	N.Y.	12-30,000	360,000	290,000	280,000	8.0	1,450	1,020	120	25.2
OLEAN	N.Y.	12-30,000	360,000	290,000	280,000	5.0	1,530	1,020	50	25.2
LEWIS RUN	PA.	21-30,000	630,000	528,000	510,000	5.0	1,530	1,020	50	46.0
ELLWOOD CITY	PA.	16-30,000	480,000	396,000	383,000	7.0	1,530	1,020	100	34.5
ELK	W.VA.	38-30,000	1,140,000	1,000,000	970,000	24.0	1,350	1,030	120	87.1
KENOVA	W.VA.	37-30,000	1,110,000	976,000	945,000	16.0	1,350	1,050	120	85.0
LEXINGTON	KY.	10-30,000 3-60,000	480,000	422,000	408,000	16.0	1,300	1,020	150	35.4
STAUNTON	VA.	3-60,000	180,000	158,000	134,000	5.1	1,250	1,035	90	13.75

SAMPLE CALCULATIONS

PROPANE – AIR GAS PRODUCED. THE AMOUNT OF PROPANE–AIR PRODUCED BY ONE GALLON OF PROPANE IS DETERMINED BY DIVIDING THE NUMBER OF BTU'S IN ONE GALLON OF PROPANE (91,500 BTU) BY THE HEATING VALUE OF THE PROPANE–AIR GAS.

FOR EXAMPLE: ONE GALLON OF PROPANE = 91,500 BTU
ONE CUBIC FOOT OF PROPANE–AIR GAS = 1,450 BTU

THEREFORE: ONE GALLON OF PROPANE = 91,500 BTU ÷ 1,450 BTU PER CUBIC FOOT OR 63 ACTUAL CUBIC FEET OF 1,450 BTU PROPANE AIR GAS. SOME TYPICAL EXAMPLES ARE:

ONE GALLON OF PROPANE = .073 ACTUAL MCF OF 1,250 BTU PROPANE–AIR GAS
ONE GALLON OF PROPANE = .070 ACTUAL MCF OF 1,300 BTU PROPANE–AIR GAS
ONE GALLON OF PROPANE = .068 ACTUAL MCF OF 1,350 BTU PROPANE–AIR GAS
ONE GALLON OF PROPANE = .065 ACTUAL MCF OF 1,400 BTU PROPANE–AIR GAS
ONE GALLON OF PROPANE = .063 ACTUAL MCF OF 1,450 BTU PROPANE–AIR GAS
ONE GALLON OF PROPANE = .061 ACTUAL MCF OF 1,500 BTU PROPANE–AIR GAS
ONE GALLON OF PROPANE = .060 ACTUAL MCF OF 1,530 BTU PROPANE–AIR GAS
ONE GALLON OF PROPANE = .059 ACTUAL MCF OF 1,550 BTU PROPANE–AIR GAS

NATURAL GAS REPLACED BY PROPANE – AIR GAS. THE AMOUNT OF NATURAL GAS REPLACED BY ONE GALLON OF PROPANE IS DETERMINED BY DIVIDING THE HEATING VALUE OF ONE GALLON OF PROPANE (91,500 BTU) BY THE AVERAGE RATING VALUE IN ONE CUBIC FOOT OF NATURAL GAS (1,050 BTU'S) FOR EXAMPLE:

ONE GALLON OF PROPANE = 91,500 BTU ÷ 1,050 BTU PER CUBIC FOOT = .0871 MCF OF 1,050 BTU NATURAL GAS REPLACED.

NiSource
Distribution Operations

Gas Standard

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EXHIBIT B
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FORM C(DSP) 1515 CSD

COLUMBIA GAS DISTRIBUTION COMPANIES
LIQUEFIED PETROLEUM GAS STATISTICS

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PROPANE PLANT BINGHAMTON — PERIOD BEGINS 8 A.M. ____ P.M. MO. 2-1 19 76 — PERIOD ENDS 8 A.M. ____ P.M. MO. 2-2 19 76

TANK NO.	BEGIN. INVENTORY GALLONS @ 60° F	ENDING INVENTORY PRESSURE	% FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS @ 60° F	GALLONS USED	TANK NO.
1	20,700		27	8,100	14	1.069	8,700	12,000	1
2	21,300		34	10,200	14	1.069	10,900	10,400	2
3	26,200								3
4	26,500								4
5	25,900								5
6	26,500								6
7	26,600								7
8	26,200								8
9	26,800								9
10	25,900								10
11	26,300								11
12	25,900								12
13	26,300								13
14	25,600								14
15	25,600								15
16	25,600								16
17	26,300								17
18	25,600								18
19	26,300								19
20	24,100								20
21	26,000								21
22	26,300	FOR ACTUAL PRODUCTION							22
23	26,300								23
24	26,300	"GAUGE ONLY THE TANKS BEING USED"							24
25	26,300								25
26	26,300								26
27	26,300								27
28	26,300								28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
TOTAL	(A) 719,500						(B) 697,100	(C) 22,400	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	719,500	GALS.@60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1. ____ Gals. ____ Gals. 3. ____ Gals. 2. ____ Gals. ____ Gals. 4. ____ Gals.	2	—	GALS.@60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 ± 2)	3	719,500	GALS.@60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	697,100	GALS.@60°F
STOCK ADJUSTMENT	5	—	GALS.@60°F
TEST RUN – PROPANE BURNT AT FLARE	6	—	GALS.@60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	22,400	GALS.@60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	1,961	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY 1460 BTU/Cu. Ft.	9	1,411	MCF

INVENTORY TAKEN BY	CALCULATIONS BY	APPROVED BY
PLANT OPERATOR	PLANT OPERATOR	PLANT SUPERVISOR

MiSource
Distribution Operations

Gas Standard

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EXHIBIT B
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STANDARD VOLUME CORRECTION FACTORS

FOR LIQUEFIED PETROLEUM GASES

SPECIFIC GRAVITY OF PROPANE AT 60°F/60°F								
°F	0.5079	0.510	°F	0.5079	0.510	°F	0.5079	0.510
-35	1.135	1.134	26	1.053	1.052	66	0.990	0.990
-30	1.129	1.128	27	1.052	1.051	67	0.988	0.988
-25	1.122	1.121	28	1.050	1.049	68	0.986	0.987
-20	1.115	1.114	29	1.049	1.048	69	0.985	0.986
			30	1.047	1.046	70	0.983	0.984
-15	1.109	1.107	31	1.046	1.045	71	0.982	0.983
-10	1.102	1.100	32	1.044	1.043	72	0.980	0.981
- 5	1.096	1.094	33	1.043	1.042	73	0.978	0.979
- 0	1.088	1.088	34	1.041	1.040	74	0.976	0.977
			35	1.040	1.039	75		
1	1.087	1.087	36	1.038	1.037	76	0.972	0.974
2	1.085	1.085	37	1.037	1.036	77	0.971	0.972
3	1.084	1.084	38	1.035	1.034	78	0.969	0.970
4	1.083	1.082	39	1.034	1.033	79	0.968	0.969
5	1.082	1.081	40	1.032	1.031	80	0.966	0.967
6	1.080	1.080	41	1.031	1.030	81	0.965	0.965
7	1.079	1.079	42	1.029	1.028	82	0.963	0.963
8	1.078	1.077	43	1.028	1.027	83	0.961	0.962
9	1.077	1.076	44	1.026	1.025	84	0.959	0.960
10	1.075	1.074	45	1.024	1.024	85		
11	1.074	1.073	46	1.022	1.022	86	0.956	0.956
12	1.072	1.071	47	1.021	1.021	87	0.954	0.955
13	1.071	1.070	48	1.019	1.019	88	0.952	0.953
14	1.070	1.069	49	1.018	1.018	89	0.951	0.951
15	1.069	1.068	50	1.016	1.016	90	0.949	0.949
16	1.067	1.066	51	1.015	1.014	91	0.947	0.948
17	1.066	1.065	52	1.013	1.012	92	0.945	0.946
18	1.065	1.064	53	1.012	1.011	93	0.943	0.944
19	1.064	1.063	54	1.010	1.009	94	0.941	0.942
20	1.062	1.061	55	1.009	1.008	95	0.940	0.941
21	1.061	1.060	56	1.007	1.006	96	0.938	0.939
22	1.059	1.058	57	1.005	1.005	97	0.936	0.937
23	1.058	1.057	58	1.003	1.003	98	0.934	0.935
24	1.056	1.055	59	1.002	1.002	99	0.932	0.934
25	1.055	1.054	60	1.000	1.000	100	0.930	0.932
			61	0.999	0.999			
			62	0.997	0.997			
			63	0.995	0.996			
			64	0.993	0.994			
			65	0.992	0.992			

NiSource
Distribution Operations

Gas Standard

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EXHIBIT B
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FORM GIDSP) 1515 CSD

COLUMBIA GAS DISTRIBUTION COMPANIES
LIQUEFIED PETROLEUM GAS STATISTICS

PROPANE PLANT BINGHAMTON | PERIOD BEGINS 8 A.M. P.M. MO. 2-6 19 76 | PERIOD ENDS 8 A.M. P.M. MO. 2-7 19 76

TANK NO.	BEGIN. INVENTORY GALLONS @ 60° F	ENDING INVENTORY PRESSURE	% FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS @ 60° F	GALLONS USED	TANK NO.
1	1,000								1
2	3,200								2
3	12,200		5	1,500	4	1.082	1,600	10,600	3
4	11,900		4	1,200	4	1.082	1,300	10,600	4
5	25,900		12	3,600	6	1.080	3,900	22,000	5
6	26,500		8	2,400	6	1.080	2,600	23,900	6
7	26,600		40	12,000	2	1.085	13,000	13,600	7
8	26,200		40	12,000	2	1.085	13,000	13,200	8
9	24,000								9
10	25,900								10
11	26,300								11
12	25,900								12
13	26,300								13
14	25,600								14
15	25,600								15
16	25,600								16
17	26,300								17
18	25,600								18
19	26,300								19
20	24,100								20
21	26,600								21
22	26,300								22
23	26,300								23
24	26,300	FOR ACTUAL PRODUCTION							24
25	26,300	"GAUGE ONLY THE TANKS BEING USED"							25
26	26,300								26
27	26,300								27
28	26,300								28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
TOTAL	(A) 653,100						(B) 559,200	(C) 93,900	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	653,100	GALS. @ 60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1. ____ Gals. 3. ____ Gals. 2. ____ Gals. 4. ____ Gals.	2	—	GALS. @ 60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 ± 2)	3	653,100	GALS. @ 60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	559,200	GALS. @ 60°F
STOCK ADJUSTMENT	5	—	GALS. @ 60°F
TEST RUN – PROPANE BURNT AT FLARE	6	—	GALS. @ 60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	93,900	GALS. @ 60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	8,160	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY 1450 BTU/Cu. Ft.	9	5,810	MCF

INVENTORY TAKEN BY	CALCULATIONS BY	APPROVED BY
PLANT OPERATOR	PLANT OPERATION	PLANT SUPERVISOR

Gas Standard

Distribution Operations

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
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FORM CIOSP\ 1515-CSO

COLUMBIA GAS DISTRIBUTION COMPANIES
LIQUEFIED PETROLEUM GAS STATISTICS

PROPANE PLANT BINGHAMTON — PERIOD BEGINS 8 A.M. P.M. MO. 2-2 1976 — PERIOD ENDS 8 A.M. P.M. MO. 2-3 1976

TANK NO.	BEGIN. INVENTORY GALLONS @ 60° F	ENDING INVENTORY PRESSURE	% FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS @ 60° F	GALLONS USED	TANK NO.
1	8,700		3	900	6	1.080	1000	7,700	1
2	10,900		10	3000	14	1.069	3200	7,700	2
3	26,200		38	11,400	10	1.074	12,200	14,000	3
4	26,500		37	11,100	10	1.074	11,900	14,600	4
5	25,900								5
6	26,500								6
7	26,600								7
8	26,200								8
9	26,000								9
10	25,900								10
11	26,300								11
12	25,900								12
13	26,300								13
14	25,600								14
15	25,600								15
16	25,600								16
17	26,300								17
18	25,600								18
19	26,300								19
20	24,100								20
21	26,000								21
22	26,300			FOR ACTUAL PRODUCTION					22
23	26,300								23
24	26,300			"GAUGE ONLY THE TANKS BEING USED"					24
25	26,300								25
26	26,300								26
27	26,300								27
28	26,300								28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
TOTAL	(A) 697,100						(B) 653,100	(C) 44,000	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	697,100	GALS. 60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1. ____ Gals. 3. ____ Gals. 2. ____ Gals. 4. ____ Gals.	2	—	GALS. 60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 ± 2)	3	697,100	GALS. 60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	653,100	GALS. 60°F
STOCK ADJUSTMENT	5	—	GALS. 60°F
TEST RUN – PROPANE BURNT AT FLARE	6	—	GALS. 60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	44,000	GALS. 60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	3,832	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY 1450 BTU/Cu. Ft.	9	2,772	MCF

INVENTORY TAKEN BY: PLANT OPERATOR
CALCULATIONS BY: PLANT OPERATOR
APPROVED BY: PLANT SUPERVISOR

MiSource
Distribution Operations

Gas Standard

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COLUMBIA GAS DISTRIBUTION COMPANIES
LIQUEFIED PETROLEUM GAS STATISTICS

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PROPANE PLANT BINGHAMTON — PERIOD BEGINS 8 A.M. P.M. MO. 2-9 1976 — PERIOD ENDS 8 A.M. P.M. MO. 2-10 1976

TANK NO.	BEGIN. INVENTORY GALLONS @ 60° F	ENDING INVENTORY PRESSURE	% FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS @ 60° F	GALLONS USED	TANK NO.
1	1,900								1
2	3,200								2
3	1,600								3
4	1,300								4
5	3,900								5
6	2,600								6
7	13,000		4	1,200	2	1.085	1,300	11,700	7
8	13,000		3	900	2	1.085	1,000	12,000	8
9	26,000		23	6,900	-5	1.094	7,500	18,500	9
10	25,900		27	8,100	0	1.088	8800	17,100	10
11	26,300								11
12	25,900								12
13	26,300								13
14	25,600								14
15	25,600								15
16	25,600								16
17	26,300								17
18	25,600	FOR ACTUAL PRODUCTION							18
19	26,300								19
20	24,100	"GAUGE ONLY THE TANKS BEING USED"							20
21	26,000								21
22	26,300								22
23	26,300								23
24	26,300								24
25	26,300								25
26	26,300								26
27	26,300								27
28	26,300								28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
TOTAL	(A) 559,200						(B) 499,900	(C) 59,300	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	559,200	GALS. 60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1.____ ____ Gals. 3.____ ____ Gals. 2.____ ____ Gals. 4.____ ____ Gals.	2	—	GALS. 60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 ± 2)	3	559,200	GALS. 60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	499,900	GALS. 60°F
STOCK ADJUSTMENT	5	—	GALS. 60°F
TEST RUN – PROPANE BURNT AT FLARE	6	—	GALS. 60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	59,300	GALS. 60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	5,150	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY 1450 BTU/Cu. Ft.	9	3,740	MCF

INVENTORY TAKEN BY: PLANT OPERATOR — CALCULATIONS BY: PLANT OPERATOR — APPROVED BY: PLANT SUPERVISOR

Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
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FORM C(OSP) 1515 C&D

COLUMBIA GAS DISTRIBUTION COMPANIES
LIQUEFIED PETROLEUM GAS STATISTICS

PROPANE PLANT BINGHAMTON — PERIOD BEGINS 8 A.M. P.M. MO. 2-10 1976 — PERIOD ENDS 8 A.M. P.M. MO. 2-11 1976

TANK NO.	BEGIN. INVENTORY GALLONS @60° F	ENDING INVENTORY PRESSURE	% FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS @60° F	GALLONS USED	TANK NO.
1	1,000		83	24,900	22	1.058	26,300		1
2	3,200		83	24,900	28	1.049	26,100		2
3	1,600		58	17,400	28	1.049	18,300		3
4	1,300								4
5	3,900								5
6	2,600								6
7	1,300								7
8	1,000								8
9	7,500								9
10	8,800								10
11	26,300								11
12	25,900								12
13	26,300								13
14	25,600								14
15	25,600								15
16	25,600								16
17	26,300								17
18	25,600								18
19	26,300	WHEN RECEIVING PROPANE							19
20	24,100								20
21	26,000	"GAUGE ONLY THE TANKS BEING FILLED"							21
22	26,300								22
23	26,300								23
24	26,300								24
25	26,300								25
26	26,300								26
27	26,300								27
28	26,300								28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
TOTAL	(A) 499,900						(B) 564,800	(C)	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	499,900	GALS. 60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1 GATX 96846 31,270 Gals. 2 NPTX 32052 31,136 Gals. 3. ____ Gals. 4. ____ Gals.	2	62,400	GALS. 60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 + 2)	3	562,300	GALS. 60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	564,300	GALS. 60°F
STOCK ADJUSTMENT	5	+ 2,500	GALS. 60°F
TEST RUN – PROPANE BURNT AT FLARE	6	–	GALS. 60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	–	GALS. 60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	–	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY ____ BTU/Cu. Ft.	9	–	MCF

INVENTORY TAKEN BY	CALCULATIONS BY	APPROVED BY
PLANT OPERATOR	PLANT OPERATOR	PLANT SUPERVISOR

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
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EXHIBIT B
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FORM CIDSP) 1515 CSD — COLUMBIA GAS DISTRIBUTION COMPANIES — Page 7 of 9

LIQUEFIED PETROLEUM GAS STATISTICS

PROPANE PLANT: BINGHAMTON — PERIOD BEGINS 8 A.M. ____ P.M. MO. 2-27 19 76 — PERIOD ENDS 8 A.M. ____ P.M. MO. 2-28 19 76

TANK NO.	BEGIN. INVENTORY GALLONS@60° F	ENDING INVENTORY PRESSURE	% FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS@60° F	GALLONS USED	TANK NO.
1	26,300		80	24,000	26	1.052	25,200	1,100	1
2	26,100							(TEST RUN)	2
3	18,300								3
4	1,300								4
5	26,400								5
6	26,400								6
7	12,000								7
8	8,500								8
9	7,500								9
10	8,800								10
11	26,300								11
12	25,900								12
13	26,300								13
14	25,600								14
15	25,600								15
16	26,600								16
17	26,300								17
18	25,600								18
19	26,300	WHEN TEST RUNS ARE MADE AND							19
20	24,100	PROPANE IS BURNED AT FLARE							20
21	26,600	"GAUGE ONLY TANK BEING USED"							21
22	26,300								22
23	26,300								23
24	26,300								24
25	26,300								25
26	26,300								26
27	26,300								27
28	26,300								28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
TOTAL	(A) 629,300						(B) 628,200	(C) 1,100	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	629,300	GALS.@60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1.____Gals. 2.____Gals. 3.____Gals. 4.____Gals.	2	—	GALS.@60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 ± 2)	3	629,300	GALS.@60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	628,200	GALS.@60°F
STOCK ADJUSTMENT	5	—	GALS.@60°F
TEST RUN – PROPANE BURNT AT FLARE	6	1,100	GALS.@60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	—	GALS.@60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	—	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY____BTU/Cu. Ft.	9	—	MCF

INVENTORY TAKEN BY	CALCULATIONS BY	APPROVED BY
PLANT OPERATOR	PLANT OPERATOR	PLANT SUPERVISOR

Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
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EXHIBIT B
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FORM CIDSP 1515 GSD

COLUMBIA GAS DISTRIBUTION COMPANIES
LIQUEFIED PETROLEUM GAS STATISTICS

PROPANE PLANT BINGHAMTON — PERIOD BEGINS 8 A.M. P.M. MO. 2-26 1976 — PERIOD ENDS 8 A.M. P.M. MO. 2-27 1976

TANK NO.	BEGIN. INVENTORY GALLONS@60° F	ENDING INVENTORY PRESSURE	% FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS@60° F	GALLONS USED	TANK NO.
1	26,300								1
2	26,100								2
3	18,300								3
4	1,300								4
5	3,900		83	24,900	20	1.061	26,400		5
6	2,600		83	24,900	20	1.061	26,400		6
7	1,300		38	11,400	26	1.052	12,000		7
8	1,000		27	8,100	26	1.052	8,500		8
9	7,500								9
10	8,800								10
11	26,300								11
12	25,900								12
13	26,300								13
14	25,600								14
15	25,600								15
16	25,600								16
17	26,300								17
18	25,600								18
19	26,300	WHEN RECEIVING PROPANE							19
20	24,100								20
21	26,000	"GAUGE ONLY THE TANKS BEING FILLED"							21
22	26,300								22
23	26,300								23
24	26,300								24
25	26,300								25
26	26,300								26
27	26,300								27
28	26,300								28
29									29
30									30
31									31
32									32
33									33
34									34
35									35
36									36
37									37
38									38
TOTAL	(A) 564,800						(B) 629,300	(C)	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	564,800	GALS.@60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1 GATX 91195 31,982 Gals. 2 NATX 34061 30,592 Gals. 3. Gals. 4. Gals.	2	62,600	GALS.@60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 ± 2)	3	627,400	GALS.@60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	629,300	GALS.@60°F
STOCK ADJUSTMENT	5	+1,900	GALS.@60°F
TEST RUN – PROPANE BURNT AT FLARE	6	–	GALS.@60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	–	GALS.@60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	–	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY BTU/Cu. Ft.	9	–	MCF

INVENTORY TAKEN BY	CALCULATIONS BY	APPROVED BY
PLANT OPERATOR	PLANT OPERATOR	PLANT SUPERVISOR

MiSource
Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
Supersedes: N/A		Page 14 of 15

EXHIBIT B
(9 of 9)

FORM 2(DSP) 1515 CSD

COLUMBIA GAS DISTRIBUTION COMPANIES
LIQUEFIED PETROLEUM GAS STATISTICS

PROPANE PLANT: BINGHAMTON — PERIOD BEGINS 8 A.M. ____ P.M. MO. 2-28 19 76 — PERIOD ENDS 8 A.M. ____ P.M. MO. 2-29 19 76

TANK NO.	BEGIN. INVENTORY GALLONS@60° F	PRESSURE	ENDING INVENTORY % FULL	UNCORRECTED GALLONS	TEMP. °F	CORRECTION FACTOR	GALLONS@60° F	GALLONS USED	TANK NO.
1	25,200		81	24,100	26	1.052	25,400		1
2	26,100		84	24,600	32	1.043	25,700		2
3	18,300		58	17,400	30	1.046	18,200		3
4	1,300		4	1,200	30	1.046	1,300		4
5	26,400		84	25,200	28	1.049	26,400		5
6	26,400		84	25,200	32	1.043	26,400		6
7	12,000		38	11,400	28	1.049	12,000		7
8	8,500		27	8,100	30	1.046	8,500		8
9	7,500		23	6,900	28	1.049	7,200		9
10	8,800		27	8,100	30	1.046	8,500		10
11	26,300		84	25,200	32	1.043	26,300		11
12	25,900		82	24,600	32	1.043	25,700		12
13	26,300		84	25,200	32	1.043	26,400		13
14	25,600		82	24,600	32	1.043	25,700		14
15	25,600		82	24,600	30	1.046	25,700		15
16	25,600		82	24,600	32	1.043	25,700		16
17	26,300		84	25,200	30	1.046	26,400		17
18	25,600		82	24,600	30	1.046	25,700		18
19	26,300		83	24,900	28	1.049	26,100		19
20	24,100		77	23,100	30	1.046	24,200		20
21	26,000		82	24,600	30	1.046	25,700		21
22	26,300		84	25,200	30	1.046	26,400		22
23	26,300		84	25,200	32	1.043	26,400		23
24	26,300		84	25,200	32	1.043	26,400		24
25	26,300		84	25,200	28	1.049	26,400		25
26	26,300		84	25,200	30	1.046	26,400		26
27	26,300		84	25,200	28	1.049	26,400		27
28	26,300		84	25,200	30	1.046	26,400		28
29									29
30	"MAKE STOCK ADJUSTMENTS ON LAST DAY								30
31	OF MONTH"								31
32									32
33	NOTE: UNCORRECTED GALLONS (599,800) CAN be multiplied								33
34	by AVERAGE TEMPERATURE (30°F) CORRECTION FACTOR								34
35	OF 1.046 WHICH GIVES CORRECTED INUENTORY OF								35
36	627,400 GALLONS. THIS IS CLOSE ENOUGH to 628,000								36
37	THAT THIS METHOD MAY BE USED IN LIEU OF MULTIPLYING								37
38	THE CORRECTION FACTOR FOR EACH TANK AS SHOWN ABOVE.								38
TOTAL	(A) 629,300			599,800			(B) 628,000	(C)	

DESCRIPTION	LINE	QUANTITY	UNIT
LIQUEFIED PETROLEUM GAS ON HAND BEGINNING OF PERIOD OR DAY ("A" Above)	1	629,300	GALS.@60°F
LIQUEFIED PETROLEUM GAS LOADED/UNLOADED TODAY 1. ____ Gals. 3. ____ Gals. 2. ____ Gals. 4. ____ Gals.	2	—	GALS.@60°F
TOTAL TO ACCOUNT FOR AT END OF PERIOD OR DAY (Line 1 ± 2)	3	629,300	GALS.@60°F
BALANCE ON HAND AT END OF PERIOD OR DAY ("B" Above)	4	628,000	GALS.@60°F
STOCK ADJUSTMENT	5	— 1,300	GALS.@60°F
TEST RUN – PROPANE BURNT AT FLARE	6	—	GALS.@60°F
L.P. GAS PUT INTO DISTRIBUTION LINE DURING THIS PERIOD OR DAY ("C" Above)	7	—	GALS.@60°F
NATURAL GAS REPLACED WITH L.P. GAS DURING THIS PERIOD OR DAY (C x .0871)	8	—	MCF
ACTUAL PRODUCTION OF PROPANE – AIR GAS DURING THIS PERIOD OR DAY ____ BTU/Cu. Ft.	9	—	MCF

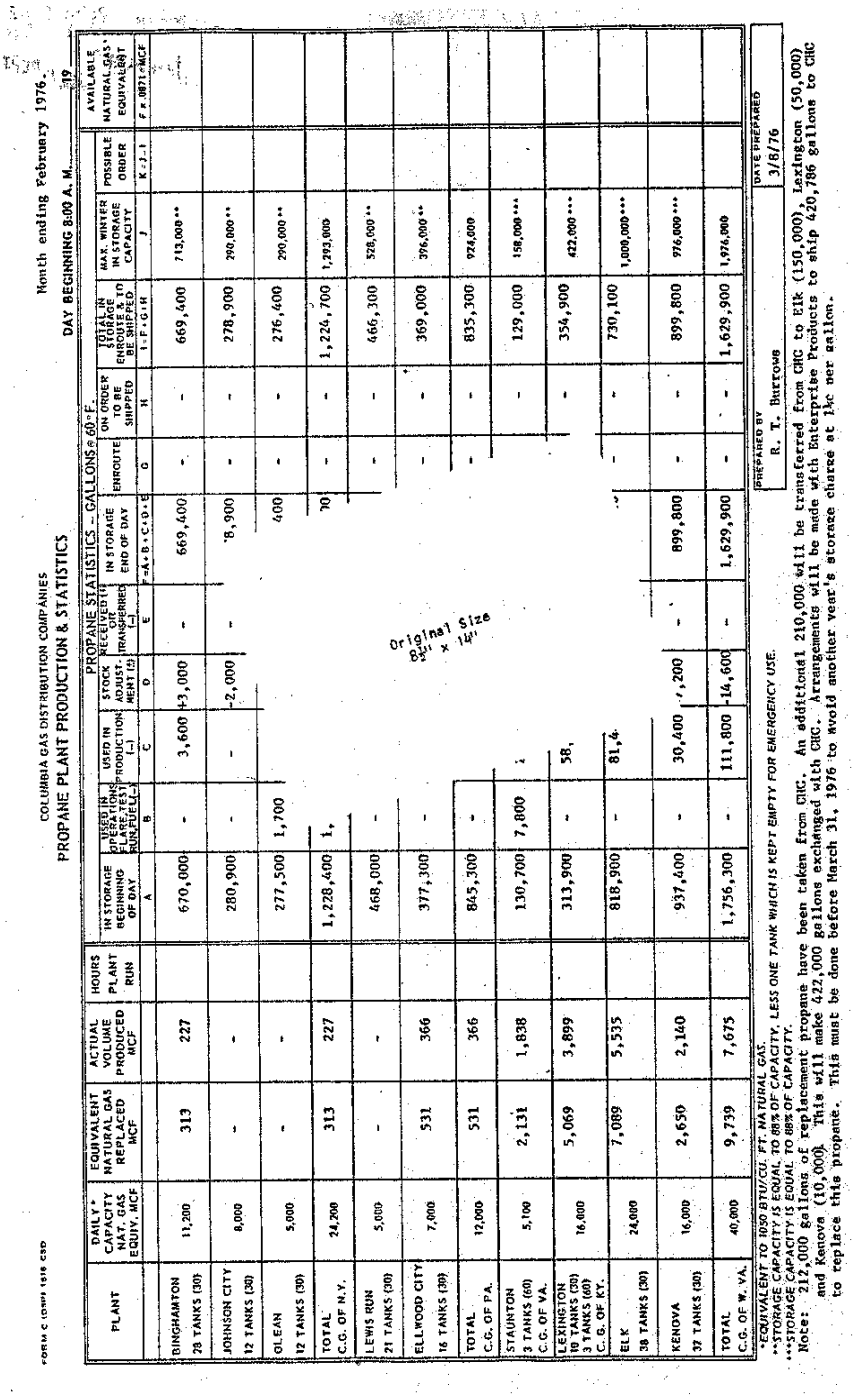
INVENTORY TAKEN BY	CALCULATIONS BY	APPROVED BY
PLANT OPERATOR	PLANT OPERATOR	PLANT SUPERVISOR

Distribution Operations

Gas Standard

Effective Date: 07/01/1977	**Accounting for Peak Shaving Plant Propane Inventory**	Standard Number: **GS 2900.900(CG)** P&P 680-1
Supersedes: N/A		Page 15 of 15

EXHIBIT C



COLUMBIA GAS DISTRIBUTION COMPANIES

PROPANE PLANT PRODUCTION & STATISTICS

Month ending February 1976

DAY BEGINNING 8:00 A.M. 19

PROPANE STATISTICS – GALLONS @ 60° F.

PLANT	DAILY* CAPACITY NAT. GAS EQUIV. MCF	EQUIVALENT NATURAL GAS REPLACED MCF	ACTUAL VOLUME PRODUCED MCF	HOURS PLANT RUN	IN STORAGE BEGINNING OF DAY A	USED IN PRODUCTION FOR TESTS RUN FUEL (–) B	USED IN PRODUCTION (–) C	STOCK ADJUST-MENT (±) D	RECEIVED IN STORAGE TRANSFERRED (+) E	IN STORAGE END OF DAY F=A+B+C+D+E	ENROUTE G	ON ORDER TO BE SHIPPED H	TOTAL IN STORAGE ENROUTE & TO BE SHIPPED I-F+G+H	MAX. WINTER IN STORAGE CAPACITY J	POSSIBLE ORDER K=J-I	AVAILABLE NATURAL GAS** EQUIVALENT F.P. 0871 MCF
BINGHAMTON 28 TANKS (30)	11,200	313	227		670,000	-	3,600	+3,000	-	669,400	-	-	669,400	713,000**		
JOHNSON CITY 12 TANKS (30)	8,000	-	-		280,900	-	-	-2,000	-	278,900	-	-	278,900	290,000**		
OLEAN 12 TANKS (30)	5,000	-	-		277,500	1,700			400	276,400	-	-	276,400	290,000**		
TOTAL C.G. OF N.Y.	24,200	313	227		1,228,400	1,			70	1,224,700	-	-	1,224,700	1,293,000		
LEWIS RUN 21 TANKS (30)	5,000	-	-		468,000	-				466,300	-	-	466,300	528,000**		
ELLWOOD CITY 16 TANKS (30)	7,000	531	366		377,300	-				369,000	-	-	369,000	396,000**		
TOTAL C.G. OF PA.	12,000	531	366		845,300	-				835,300	-	-	835,300	924,000		
STAUNTON 3 TANKS (60) C.G. OF VA.	5,100	2,131	1,838		130,700	7,800				129,000		-	129,000	158,000***		
LEXINGTON 10 TANKS (30) 3 TANKS (60) C.G. OF KY.	16,000	5,069	3,899		313,900	-	58,			354,900		-	354,900	422,000***		
ELK 38 TANKS (30)	24,000	7,089	5,535		818,900	-	81,4				-	-	730,100	1,000,000***		
KENOVA 37 TANKS (30)	16,000	2,659	2,140		937,400	-	30,400	,200	-	899,800	-	-	899,800	976,000***		
TOTAL C.G. OF W. VA.	40,000	9,739	7,675		1,756,300	-	111,800	-14,600	-	1,629,900	-	-	1,629,900	1,976,800		

Original Size 8½" x 14"

*EQUIVALENT TO 1050 BTU/CU. FT. NATURAL GAS.

**STORAGE CAPACITY IS EQUAL TO 85% OF CAPACITY, LESS ONE TANK WHICH IS KEPT EMPTY FOR EMERGENCY USE.

***STORAGE CAPACITY IS EQUAL TO 88% OF CAPACITY.

Note: 212,000 gallons of replacement propane have been taken from CHC. An additional 210,000 will be transferred from CHC to Elk (150,000), Lexington (50,000) and Kenova (10,000). This will make 422,000 gallons exchanged with CHC. Arrangements will be made with Enterprise Products to ship 420,786 gallons to CHC to replace this propane. This must be done before March 31, 1976 to avoid another year's storage charge at 1¼c per gallon.

PREPARED BY R. T. Burrows

DATE PREPARED 3/6/76

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Distribution Operations

Gas Standard

Effective Date: 11/05/2007	**Pipe On-Site Handling, Stringing, and Storage**	Standard Number: **GS 3000.010(CG)**
Supersedes: N/A		Page 1 of 3

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE Code of Federal Regulations - Title 49 - Part 192 – Subparts G, I, and M (192.727)

1. GENERAL

The requirements of this standard apply only to pipe handling, stringing, and storage on the job site or staging area.

2. HANDLING PIPE

Care shall be taken in handling, hauling, unloading and placing pipe, to prevent damage to the pipe or pipe coating. All parts of trucks and equipment used to transport the pipe, which could damage the pipe or coating by coming in direct contact with it, shall be properly padded with canvas belting, rubber sheets, tires, excelsior, or other material that provides adequate bearing surface and protects the pipe and coating from damage.

Caution shall be taken to prevent kinking, buckling, or gouging since these may result in weakening the pipe over a period of time. Care shall be exercised to avoid rough handling of pipe. Pipe shall not be placed, pushed or pulled over sharp projections, dropped, or have other objects dropped upon it. Damaged coating must be repaired according to Procedure Reference No. 640-9, "Installation of Corrosion Control Materials."

Care shall be exercised to protect plastic material or pipe coating from fire, damaging heat or harmful chemicals, such as gasoline, and cleaning solvents containing benzene or toluene.

Hauling of pipe and other materials shall be done in compliance with applicable regulations of all governmental agencies. Contractors shall secure from such agencies any special permits required.

Full length joints of 6" or greater diameter steel pipe shall be mechanically lifted, using appropriately designed lifting devices, such as end hooks, padded tong, or slings. These shall not be lifted by hand.

Slings used in handling pipe shall be of sufficient length that steel end connectors are not in contact with the coating.

Bare cables, chains, or metal bars shall not be permitted to come in contact with plastic or

coated pipe. Padded skids shall be used to prevent damage to coated pipe.

When unloading pipe, the pipe shall not be permitted to roll free. Extreme caution shall be used when the pipe is held and guided by hand or by rope.

When loading or unloading pipe, care shall be taken to prevent damage to the pipe ends. Avoid knocking one joint of steel pipe with the end of another.

When cutting the straps on coiled plastic pipe caution shall be exercised to control the spring effect of the coiled plastic pipe to prevent bodily harm, damage to property or the pipe itself.

3. STRINGING PIPE

Pipe shall be strung on or as close to the "beginning of construction date" as practical.

In general, the pipe should be strung along the right-of-way. However, it may be placed in piles on approved sites for welding, coating, storage, etc.

Stringing along city streets or alleys shall be done with the utmost care and consideration for the public and property owners. In the cases where the pipe is strung, sufficient spaces shall be left to pro-vide for pedestrian or vehicular traffic, where necessary.

4. ON THE JOB STORING

Valves, casing and other large and durable materials may be placed directly on the job, provided such practice will not result in their loss or damage.

When storing pipe on the job, consideration should be given to selecting sites to prevent damage to the pipe. Do not store directly on hot surfaces such as asphalt or concrete. When possible, plastic pipe should be stored in a shaded area at the job site to minimize the temperature difference between the pipe and the soil. Pipe shall not be stored in close proximity of high voltage power lines.

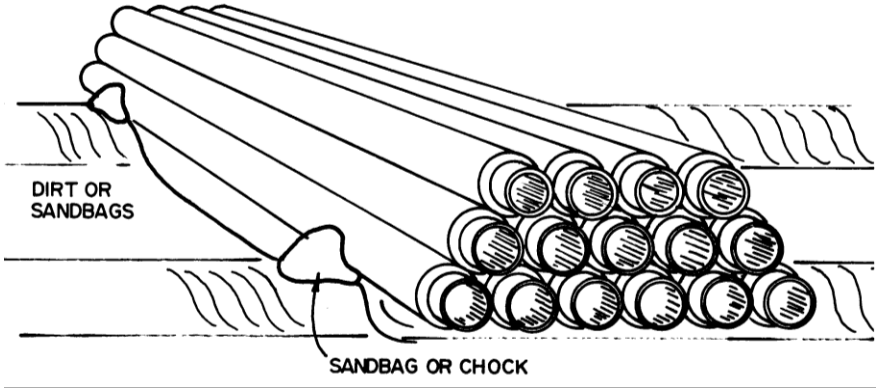
The surface of the ground upon which pipe is to be stored should be free of rocks, cinders or other objects with sharp edges which might damage the coated steel or plastic pipe.

Pipe should be handled and stored in such a manner as to prevent dirt, debris, or water from entering it. This can be accomplished by placing the pipe on padded skids or on piles of soft dirt or dirt filled sandbags. See illustration below.

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/05/2007	**Pipe On-Site Handling, Stringing, and Storage**	Standard Number: **GS 3000.010(CG)**
Supersedes: N/A		Page 3 of 3



When coated pipe is piled or stacked at the job site, the bottom row shall be placed on an earth surface free of obstruction, or on padded skids, dirt or sand tiers spread no further than 20 feet apart. (The bottom rows should be restrained to prevent the joints from avalanching.) Sand or dirt tiers three inches deep and three pipe diameters in width will serve satisfactorily as a pad over concrete or other hard surfaces.

Lay out the entire bottom row before tiering. The number of tiers should be limited as follows for coated steel pipe on soft level earth:

Nominal Pipe Diameter	Number of Tiers
2" and 3"	9
4"	7
6" through 10"	5
12" and 14"	4
16" and Greater	3

Pipe must be nested evenly.

Where freezing weather conditions are anticipated, pipe should be nested on straw and straw placed between pipe joints to prevent the coating from freezing to the ground or the adjacent joints.

NiSource
Distribution Operations

Gas Standard

Effective Date: 05/01/2016	**Inspection of Materials**	Standard Number: **GS 3000.020**
Supersedes: 10/13/2014		Page 1 of 8

Companies Affected:

☑ NIPSCO	☐ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR 192.307

1. GENERAL

This standard describes the procedure for the inspection of pipe and components that are received and installed at a job site.

2. INSPECTION REQUIREMENTS

All pipe and components must be visually inspected at the job site before installation to ensure they are appropriate for the design and application, have the proper marking, and do not have any determinable damage that could impair their serviceability. Inspection shall also be performed after installation to detect any damage that occurred during construction activities.

Pipe or components that are rejected because they do not match the required specifications, show signs of poor manufacturing workmanship or are damaged shall be appropriately repaired, replaced or returned to the supplier/manufacturer.

In addition a material failure report shall be completed in accordance with Gas Standard GS 1652.010 “Investigation of Failures.”

Sections 3 through 7 of this standard provide addition information on material markings, steel and plastic pipe inspection, outdoor storage limits for plastic pipe, component inspection and records.

3. MARKING REQUIREMENTS

Each valve, fitting, length of pipe, and other component must be marked as follows.

a. As prescribed in the specification or standard to which it was manufactured, except that polyethylene fittings must be marked in accordance with ASTM D2513-09a; or,

b. To indicate size, material, manufacturer, pressure rating, and temperature rating, and as appropriate, type, grade, and model.

3.1 Steel Pipe Markings – API 5L

Steel pipe manufactured to API 5L shall include the following information.

a. Manufacturer's name or mark.
b. "Spec 5L".
c. Size – inches.
d. Weight per foot – in pounds per foot.
e. Grade.
f. Process of manufacturer.
g. Type of steel – not required for open-hearth or basic-oxygen.
h. Heat treatment – only required if heat treatment was applied.
i. Test pressure – only required when the hydrostatic test pressure was higher than the listed tabulated pressure in API 5L.
j. Supplemental requirements – only required when applicable.

For pipe less than two (2) inches in diameter, the information shall be die-stamped on a metal tag and attached to the bundle, or may be printed on the straps or banding clips used to tie the bundle.

For all other sizes of seamless pipe and welded pipe up to 16 inches in diameter, the information shall be paint-stenciled on the outside of the pipe beginning at a point between 18 inches and 30 inches from the end.

For welded pipe 16 inches in diameter and greater, the information shall be paint-stenciled on the inside of the pipe beginning at a point no less than six (6) inches from the end.

3.2 Plastic Pipe Markings – ASTM D2513

Plastic pipe shall be marked according to ASTM D2513-09a. Markings on plastic pipe shall be legible, visible, permanent (must remove part of the pipe wall to remove the marking), repeat at intervals of not more than two (2) feet, and include the following information.

a. "GAS".
b. The designation "ASTM D2513".
c. The manufacturer's name or trademark.
d. The normal pipe size, including the sizing system used (IPS, CTS, or OD),

the Standard Dimension Ratio (SDR) or minimum wall thickness.

e. Material designation (e.g., PE 2708 or PE 4710).

f. Date of manufacture.

g. A coding that will enable the manufacturer to determine the location of the production, resin lots and any other applicable information.

3.3 Plastic Fusion Fitting Markings – ASTM D2513

Plastic fittings shall be marked according to ASTM D2513-09a. All markings shall include the following information.

a. "ASTM D2513" and all applicable specification(s) for the fitting, e.g., for an electrofusion coupling, ASTM F1055.

b. Manufacturer's name or trademark or both.

c. Size.

d. A coding that will enable the manufacturer to determine the location of the production, resin lots and any other applicable information.

3.4 Plastic Mechanical Fitting Markings

Plastic mechanical fittings shall be marked in accordance with the specification to which they are manufactured.

4. STEEL PIPE INSPECTION

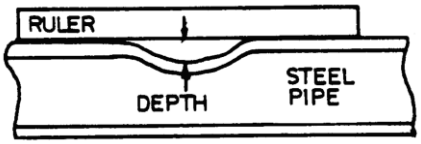
The pipe and coating on steel pipe shall be carefully inspected for any visible physical damage before being lowered into the trench or excavation.

For appropriate action to repair steel pipe, see Gas Standard GS 3010.010 "Repair of Steel Pipe."

Surface damage or imperfection areas that would impair the serviceability are described below.

4.1 Dents

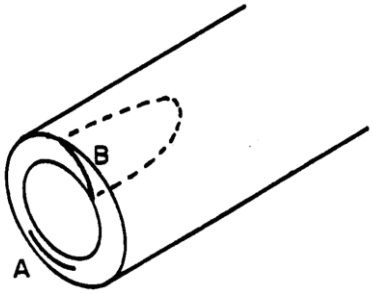
The depth of a **dent** is measured as the gap between the lowest point of the dent and a prolongation of the original contour of the pipe (see illustration below). A pit depth gage will usually work for this purpose. A dent cannot exceed the maximum limits shown on Table 1, nor have a sharp contour, gouge, or groove.



DENT

4.2 Laminations

"Laminations" are hairline separations in the pipe material and normally parallel the pipe surface, as illustrated by Point A below. Non-parallel laminations, Point B, have the effect of reducing effective wall thickness. Lamination usually occurs in spots of a few square inches but can cover a larger area. Observed laminations shall be removed.



LAMINATION

4.3 Other Defects

Other defects can be imperfections such as scratches, grooves, or gouges. They shall be repaired by grinding if the imperfection is not greater than that shown in Table 1. Remaining pipe wall thickness must equal or be greater than the minimum wall required for the pressure service application.

TABLE 1

PIPE		DENTS		OTHER DEFECTS
NOMINAL DIAMETER	WALL THICKNESS	MAXIMUM DEPTH	MAXIMUM LENGTH	MAXIMUM DEPTH*
2"	0.154" 0.218"	1/4"	1"	0.019" 0.027"
3"	0.188" 0.216"	1/4"	1 1/2"	0.024" 0.027"
4"	0.188" 0.219" 0.237"	1/4"	2"	0.024" 0.027" 0.030"

PIPE		DENTS		OTHER DEFECTS
NOMINAL DIAMETER	WALL THICKNESS	MAXIMUM DEPTH	MAXIMUM LENGTH	MAXIMUM DEPTH*
6"	0.188" 0.203"	1/4"	3"	0.023" 0.025"
8"	0.172" 0.188" 0.219"	1/4"	4"	0.021" 0.023" 0.027"
10"	0.188" 0.219" 0.250"	1/4"	5"	0.023" 0.027" 0.031"
12"	0.203" 0.219" 0.250" 0.281"	1/4"	6"	0.025" 0.027" 0.031" 0.035"
16"	0.219" 0.250" 0.281" 0.312"	1/3"	8"	0.027" 0.031" 0.035" 0.039"
18"	0.250" 0.281" 0.312"	1/3"	9"	0.031" 0.035" 0.039"
20"	0.250" 0.281" 0.312"	1/3"	10"	0.031" 0.035" 0.039"
24”	0.375” 0.438” 0.500”	1/3”	12”	0.046” 0.054” 0.060”
30”	0.0375 0.500”	1/3”	15”	0.046” 0.060”

* 12 1/2% of specified wall thickness

4.4 Coating Inspection

Steel pipe coating shall be inspected according to Gas Standard GS 1420.410 “Corrosion Control – Inspection of Steel Pipe Coating.”

Lacerations of the protective coating should be carefully examined prior to the repair of the coating to see if the pipe surface has been damaged.

5. PLASTIC PIPE INSPECTION

Plastic pipe and components shall be inspected at the installation site for damage and imperfections. The inspection shall include the following.

a. Visual inspection for cuts, gouges, scratches, kinks, and other defects.

b. Prior to installation visual inspection of the open end of the pipe for defects such as thinning of the pipe wall.

Plastic pipe found with defects such as thinning of the wall thickness shall not be installed and a material failure report shall be completed.

Plastic pipe which has been damaged by a kink or, a gouge or scratch deeper than 10% of the wall thickness shall not be installed. For appropriate action to repair plastic pipe, see Gas Standard GS 3010.020 “Repair of Plastic Pipe.”

5.1 Plastic Pipe Outdoor Storage Limit

In accordance with ASTM D2513-09a, plastic pipe has a maximum allowable outdoor storage life. Plastic pipe that is older than the allowed maximum interval from the date of manufacture shown in the print line on the pipe shall not be installed. Maximum intervals for the two types of materials used by NiSource are shown in Table 2.

Table 2 – Maximum Allowable Outdoor Storage for Plastic Pipe

Material Designation	Color	Maximum Interval from Date of Manufacture	
		Date on pipe is March 6, 2015 or later	Date on pipe is prior to March 6, 2015 *
PE 2406/2708	Yellow	3 years	2 years
PE 3408/4710	Black with yellow stripes	10 years	

* Pipe manufactured prior to March 6, 2015 to be installed after that date meets the requirements for the longer three (3) or ten (10) year outdoor storage limit if the operator can show that the pipe was manufactured in accordance with ASTM D2513-09a. The following records must be available for inspection.

a. Certificates of conformance for the specific lots of pipe being installed.

b. Construction inspection records to confirm the pipe installed matches the lot numbers on the certificates of conformance.

c. A letter of conformance for pipe manufactured by Performance Pipe is shown in Exhibit A. The letter states Driscopipe 6500 and 8300 manufactured from January 2010 to the present meets the specifications of ASTM D2513-09a. This pipe qualifies for the three (3) year (Driscopipe 6500) and ten (10) year

(Driscopipe 8300) outdoor storage limits.

6. COMPONENTS

Components must be visually inspected prior to installation. Any damage or imperfections that can be repaired must be done by a qualified person, either Company or manufacturer representative.

If metallic components are coated, the coating must also be inspected and repaired as necessary.

If the component or its coating, if applicable, cannot be repaired, then the component must be rejected and replaced.

7. RECORDS

All reports of inspections and any required repairs shall be kept with the work installation records for the life of the pipe or component.

Any piping qualified for use by a testing facility shall be documented in the work completion records with copies of the testing results.

NiSource
Distribution Operations

Gas Standard

Effective Date: 05/01/2016	**Inspection of Materials**	Standard Number: **GS 3000.020**
Supersedes: 10/13/2014		Page 8 of 8

EXHIBIT A

Letter from Performance Pipe certifying that pipe and fittings that were produced without rework met the requirements of ASTM D2513-09a and ASTM 2513-99 from January 2010 to the present.

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

Karen Lively
Technical Manager

5085 W. Plano Pkwy
Suite 500
Plano, TX 75093

Phone: 972-599-7413
Cell: 214-507-4149
livelks@cpchem.com

www.performancepipe.com

April 27, 2016

Timothy Wojcinski
Standards Engineer
NiSource
801 E. 86th St.
Merrillville, IN 46410
TJWojcinski@NiSource.com

RE: Production to ASTM D2513-09a

Dear Tim,

You provided us with a copy of DIMP FAQ and asked if we could provide a letter stating when our products were produced to the requirements of D2513-09a.

Performance Pipe gas distribution pipe products including Driscoplex® 6500 pipe and Yellowstripe® 8300 met the requirements of both ASTM D2513-09a and ASTM D2513-99 from January 2010 through the present. The pipes that meet ASTM D2513-09a will have a date code from 2010 through the present.

All Performance Pipe gas distribution fitting products were produced to the requirements of both ASTM D2513-09a and ASTM D2513-99 from January 2010 through the present.

With Regards,

Karen Lively
Technical Manager

cc Barney Camponeschi

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/05/2007	**High Voltage Precautions during Construction**	Standard Number: **GS 3000.100(CG)**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

Where the pipeline is being installed near high voltage electric lines, the following procedure shall be followed:

a. Use blow down connections that will direct the gas away from the electric conductors.

b. Rubber tired vehicles should be kept out of close proximity of high voltage electric lines, unless equipped with grounding straps.

c. Minimum clearances, as specified by the electric company, shall be maintained between the electric facilities and construction equipment, materials and personnel. If necessary, an electric company representative should be contacted for grounding recommendations.

2. REQUIREMENTS FOR STEEL MAINS

Where a steel main is being installed near high voltage electric lines, the following additional procedures shall be followed:

a. Install a bonding conductor across points where pipe separation will occur and maintain this connection while the pipeline is separated. The current carrying capacity of the bonding conductor should be at least one-half of the capacity of the over-head line conductors. The electric company shall be contacted prior to working near high voltage electric lines.

b. Establish an electrical ground between all pipe and ground rods prior to any physical contact with the pipe during construction near electric lines. This applies to pipe when it is on skids, and to loose joints being moved into position for welding.

On long sections of exposed steel pipe paralleling the high voltage lines, temporary electrical grounds should be installed at intervals not greater than 1,000 feet, with the first ground installed at the beginning of the section. Pipe joints being moved under the influence of the high voltage lines should be equipped with a trailing ground chain or copper strap dragging on the ground to dissipate induced voltage on the pipe.

Ground rods should be 6'to 8' copper weld rods driven at least 3' in the ground. All ground wire connections must be securely made so they cannot be accidentally dislodged. Grounding wires shall be in good mechanical and electrical condition and of sufficient conductivity. A #2 AWG standard welding cable or equivalent is recommended.

Maintain driven earth ground rods for pipe in the ditch, since the coating is capable of preventing the pipe from grounding to earth. When connecting the pipe and ground rod, connect the wire to the driven ground rod first and then to the pipe.

3. REQUIREMENTS FOR PLASTIC MAINS

Where a plastic main is being installed near high voltage electric lines, a significant voltage can be induced on the locating wire. There-fore, to avoid serious injury to personnel, check the locating wire for voltage between the locating wire and ground. If the measured voltage exceeds 15 volts, contact the Operations Engineer.

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/05/2007	**Valve Placement and Support**	Standard Number: **GS 3000.200(CG)**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE Code of Federal Regulations - Title 49 - Part 192 – Subparts G, I, and M (192.727)

1. GENERAL

Valves shall be placed in a readily accessible location so as to facilitate their operation and the operating stems or mechanisms shall be readily accessible.

Valves shall be installed in a manner to minimize secondary stress which might be exerted on the main through the valve or its enclosure. This can be accomplished by blocking and/or strapping for steel valves or a valve box support for plastic valves. Permanent blocking with wood is prohibited. The use of a concrete pad or concrete block is recommended. The concrete mixture shall consist of one part cement, three parts of fine aggregate, and six parts of coarse aggregate.

If a metal valve box is used with a steel valve, it may not be sup-ported by or be in contact with the valve or main. It must be supported by a concrete pad, concrete block or other suitable means of support.

When metallic valves are to be welded or preheated, the procedure shall be such that there is no damage to the mechanisms. When damage is anticipated, the mechanism shall be removed or the manufacturer's installation instructions shall be followed.

It is recommended that plastic valves with butt fusion ends be installed in plastic mains. However, if steel valves are installed, valve and valve box installations shall be installed to protect the plastic mains against torsional or shearing loads when the valves are operated. This can be accomplished by installing a minimum of one foot of steel pipe on both sides of a weld-end gate valve. If necessary, cross pieces bolted or welded to the assembly should be installed to prevent rotation of the valve.

Plastic valves shall be protected against torsional or shearing loads using an approved valve box and valve box base.

During installation the valve shall be cycled through the full open and full close to assure that it is fully operational. On buried valves, a gate key shall be used to assure that the valve is accessible and operable after backfilling.

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/05/2007	**Valve Placement and Support**	Standard Number: **GS 3000.200(CG)**
Supersedes: N/A		Page 2 of 2

2. RECORDS

The "Valve Location Record," or applicable computer facility data, shall be maintained in accordance with Gas Standard GS 1760.010, "Critical Valve Inspection and Maintenance."

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Internal Cleaning of Pipelines**	Standard Number: **GS 3000.500**
Supersedes: N/A		Page 1 of 7

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR Part 192.303

1. GENERAL

This gas standard provides direction for internally cleaning new, replaced and existing steel and plastic pipelines (i.e., transmission lines, distribution mains, service lines).

The purpose of cleaning the pipeline is to remove water and/or foreign debris that could affect the volume or pressure of natural gas delivered to the customer and/or affect the operation of pressure regulating and gas measurement equipment.

Except as noted in this standard, pipelines shall be cleaned prior to pressure testing.

Prior to placing the pipeline in service, additional cleaning of the pipeline is required when it is known or it is suspected that water or debris has entered the pipeline.

Pipelines that are being abandoned do not require internal cleaning.

This standard does not apply to the following.

a. Dewatering pipelines after performing a hydrostatic pressure test. Hydrostatic pressure tests require liquids removal from the pipeline and specialized procedures for handling and disposing of test water. Refer to the 1500 series of gas standards for additional information.
b. Use of pigs during purging operations.
c. Use of pigs during in service in-line inspection (smart pig) operations.

2. METHOD OF CLEANING

Except as noted below, Table 1 prescribes the cleaning method to be used for various sizes and lengths of transmission lines, distribution mains and service lines.

Note: The cleaning methods in Table 1 are not required if the pipe is straight and a visual inspection of the entire segment of the pipe is performed and one can visually see and determine there is no water or debris in the pipe.

Table 1

Nominal Pipe Size and Length	Cleaning Method
1-1/4 inch or smaller AND any length	Compressed Air or Inert Gas
2 inch AND 40 feet or less	Compressed Air or Inert Gas
2 inch AND Greater than 40 feet	Pig
Greater than 2 inch AND any length	Pig

Natural gas shall not be used to internally clean a pipeline or to propel the cleaning pig.

3. SAFETY

Prior to internal pipe cleaning operations the following safety precautions shall be followed.

a. Conduct a briefing with those associated with the task. Document that the briefing has occurred.

b. Follow all required safety procedures found in the following documents to avoid injuries to employees, the public, and damage to property.

   1. Columbia – HSE 4100 and 4200 Series of standards.
   2. NIPSCO – Safety Manual.

c. No person shall enter the excavation in which the pipeline is being cleaned (compressed air or pig) until it is verified that the pipeline has been depressurized.

d. All personnel shall exit excavations prior to introducing pressure to the pipeline, (e.g., compressed air used to clean a service line, launching or receiving a pig).

e. For open pipe ends, all personnel shall not be in the line of sight and remain at a safe distance to avoid being struck with debris that may exit the pipe end.

f. Ensure adequate ventilation is present when using inert gas for cleaning to avoid the hazard of asphyxiation.

4. CLEANING BY COMPRESSED AIR OR INERT GAS

Steps shall be taken to secure the hose in which the compressed air or inert gas travels through. For Columbia refer to HSE 4100.050 “Tools and Equipment – Plant Operations.”

The pipeline can be considered to be cleaned when no visible debris exiting the pipe is observed. If in doubt, turn off the compressed air or inert gas and perform a visual inspection at the receiving end of the pipeline, looking into the pipe, to determine if debris is visible. If debris is visible continue with the cleaning operation.

By no means shall a visual inspection of the pipe be performed while compressed air or inert gas is being forced into the pipeline.

5. CLEANING BY PIGGING

5.1 Selection of Pigging Devices

The type of cleaning pig used depends upon the pipeline material (e.g., steel, plastic, etc.), pipeline configuration and pipeline internal diameter.

Pipeline configuration (different diameters, offsets, fittings) shall be considered when selecting the length of the pipeline segment to be cleaned.

Used pigs may be used as long as they are in good working condition.

The following pig types are common for cleaning operations.

a. Bare foam: Cleaning and dewatering (most effective seal).

b. Polyurethane coated foam: Cleaning and dewatering (durable, for long runs and steel pipe).

c. Polyurethane coated abrasive: Cleaning and scraping (slag and scale removal)

Note: Bare foam pigs shall be used for polyethylene piping to avoid damage to the pipe.

5.2 Pressure and Flow

Running speed of a pipeline pig directly affects the performance of the pigging operation. Sufficient pressure shall be provided to move the pigging device.

At no time shall the launching or running pressure exceed a pressure determined to yield the pipe or exceed the maximum working pressure of installed fittings.

Suggested pigging pressures and flows are included in Exhibit A. For pipe diameters not listed in Exhibit A, contact Engineering.

5.3 Pig Launchers

Pig launchers are used to launch the pig into the pipeline.

A pig launcher assembled by the Company or contractor shall be made with pipe and fittings rated for the pressures to be used to launch and run the pig through the pipeline.

Joints in the assembly shall be done in accordance with approved joining methods (e.g., Welding Manual, GS 1300 Series gas standards). If mechanical fittings are used in the launcher they shall have pullout protection.

5.4 Pig Receiver

Pig receivers are used to receive the pigs after they have made a successful run.

A pig receiver assembled by the Company or contractor shall be made with pipe and fittings rated for the pressures to be used to run the pig through the pipeline and into the receiver.

Joints in the assembly shall be done in accordance with approved joining methods (e.g., Welding Manual, GS 1300 Series gas standards, etc.). If mechanical fittings are used in the receiver they shall have pullout protection.

The length of the receiver shall be a minimum of three (3) times the length of pig device being used. Exhibit B provides an example.

Except as noted below, a pig receiver shall be used.

Note: A receiver does not need to be installed if all the following conditions can be met.

a. Pipe end is in an excavation.
b. Exposed utility(s) in the excavation and in the line of fire of the pigging device is protected from the pigging device.
c. Portion of the excavation where the pig could leave the excavation can be completely covered by a steel plate.
d. Pigging device cannot exit the excavation.

5.5 Pigging Operations

The following procedures shall be followed.

a. Pigging operations shall not commence until communication has been completed and confirmed by employees involved in the launching and receiving of the pigging device.

b. Visually inspect each pig for damage before each run. If damage is observed that would affect the operation of the pig, such as gouges or cuts, the pig shall be replaced. Pigs saturated (soaked) with water shall not be used.

c. Pigging devices for pipeline cleaning purposes shall be propelled only with non-combustible gases.

d. Only devices and materials designed and intended for internal pipeline cleaning shall be used (see Section 5.1).

e. Except as noted in Section 5.4, a cleaning pig shall be used with a launcher and receiver.

f. Prior to removing the launcher and receiver, verify the pipeline, launcher, and receiver have been depressurized by observing pressure gauges.

g. In the event that a pig device does not make it to the receiver/end of pipe or if other problems exist the following actions shall take place.

1. Stop the pigging operation in a safe manner.
2. Discuss how to remedy the condition.
3. Conduct a safety briefing to communicate changes to impacted employees prior to commencing the pigging operation.
4. Document the safety briefing.

5.6 Storage of Pigs

Pipeline pigs shall be stored according to the manufacturer's instructions including shelf life where applicable. If and when the original manufacturer's storage instructions are not available or known, protect pigging devices from exposure to UV light, chemicals and physical damage.

MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Internal Cleaning of Pipelines**	Standard Number: **GS 3000.500**
Supersedes: N/A		Page 6 of 7

EXHIBIT A

Typical Pigging Pressures and Flow Rate

Pipe ID (Inches)	Pressure (PSI)			Flow rate (SCFM)	
	Launching	**Running**		**5fps**	**10fps**
2	100-200	40-100		21	98
3	100-150	35-85		46	172
4	75-125	30-80		70	273
6	50-100	30-75		134	498
8	30-80	25-70		238	749
10	30-60	25-50		317	957
12	30-50	20-45		458	1223

Notes:
1. Pressures and flow rate are approximate and guidelines only. These are not to be considered as absolute requirements.
2. Actual field requirements will vary according to type of pipe, materials in the pipe, viscosity, temperature and type of pig.

Source: Girard Industries

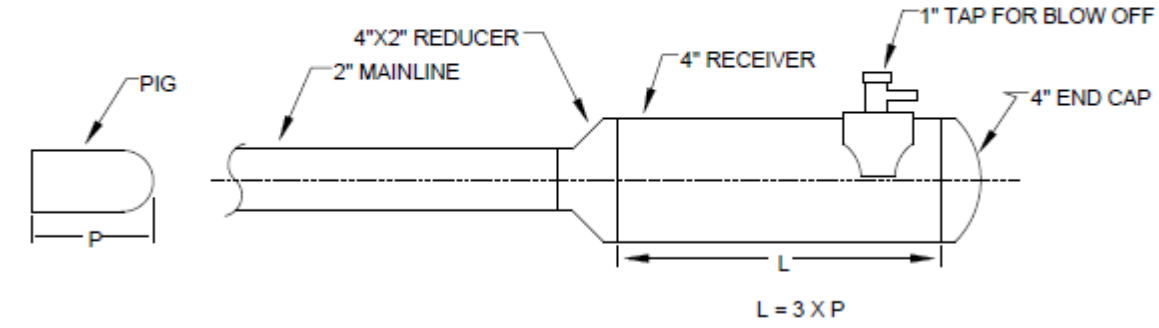
MiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Internal Cleaning of Pipelines**	Standard Number: **GS 3000.500**
Supersedes: N/A		Page 7 of 7

EXHIBIT B

EXAMPLE: PIG RECEIVER WITH LARGER DIAMETER RECIEVER



L = 3 X P

The length of the receiver (L) shall be a minimum of three (3) times the length of pig device being used. Receivers may be designed longer than shown to permit re-use of receivers.

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/05/2007	**Construction Site Cleanup**	Standard Number: **GS 3000.900(CG)**
Supersedes: N/A		Page 1 of 3

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE

1. GENERAL

Clean-up work shall closely follow backfilling and shall be finished as soon as possible. As construction work is completed, the right-of-way and surrounding ground shall be cleared of all equipment, extra materials, rubbish and debris remaining from the work. The premises shall be left in a neat and presentable condition.

2. CLEANUP BY SITE TYPE

2.1 Cultivated Land

On cultivated and improved land, all rock, skids and other rubbish, resulting from the construction which might interfere with cultivation, shall be removed.

2.2 Burning

Open burning of any remaining brush, timber or construction debris is prohibited except by permit and in accordance with the applicable provisions of the local governmental agency.

2.3 Sloping Ground

Terraces may be constructed on sloping ground to prevent erosion. The design of the terraces shall be determined by the person in charge, in cooperation with the property owner.

2.4 Waterways and Ditches

All waterways, ditches and drains shall be cleaned out and restored to at least the condition existing prior to the commencement of construction.

2.5 Lawns

After all rock and rubbish have been removed and the grading has been completed, the right-of-way shall be smoothed to present a finished appearance. Disturbed portions of lawns will be replaced with topsoil and seed commensurate with the

conditions existing prior to construction. Sod removal and replacement may be required in certain areas. The person in charge shall designate the method of lawn replacement in each case.

2.6 Fencing

All fences which have been cut or removed during the construction work shall be repaired, and matched as closely as practical to the original style of the fence. When there is any doubt as to the usability of old fence material, new material shall be used in making such repairs. Fence repairs shall be in accordance with the reasonable desire of the property owner.

2.7 Paved Areas

All sections of sidewalks, driveways and roadways damaged by construction shall be replaced in accordance with local governmental requirements and in accordance with the reasonable desires of the property owner.

2.8 Coating Spills

Care shall be taken to remove all coating spills.

3. RECORDS

Complete all required records and reports to indicate the cleanup work done, such as the size and amount of surface restoration, or other materials used.

MiSource
Distribution Operations

Gas Standard

Effective Date: 11/05/2007	**Construction Site Cleanup**	Standard Number: **GS 3000.900(CG)**
Supersedes: N/A		Page 3 of 3

EXHIBIT A
(1 OF 2)

Exhibit Formatting

Label Right Justified, all Caps, Arial 12 Bold, if more than 1 page – add page numbers as follows (1 of 2), same font, right justified, same font size, 0 point line spacing between page numbers and EXHIBIT.

Title is Centered, Title Case, Arial 12 Bold.

MiSource

Gas Standard

Distribution Operations

Effective Date: 11/05/2007	**Reporting Gas Used During Construction**	Standard Number: **GS 3000.920(CG)**
Supersedes: N/A		Page 1 of 5

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☑ CPA

REFERENCE None

1. GENERAL

Gas used during construction activities should be accounted for when it would significantly affect the unaccounted-for gas (UFG) in a Market. Guidance for determining gas lost volume is found in Exhibit A.

The Operations Manager (or equivalent) is responsible for determining which construction activities cause gas losses that are significant to a Market. (Refer to legacy CDC Procedure Reference No. 350-7, "Accounting for Gas Used in Company Operations and Municipal Free Gas.")

2. RECORDS

Form C-2378, "Estimate of Unmeasured Gas Used and Lost," (Exhibit B) should be completed to account for gas used during construction activities

MiSource

Gas Standard

Distribution Operations

Effective Date: 11/05/2007	**Reporting Gas Used During Construction**	Standard Number: **GS 3000.920(CG)**
Supersedes: N/A		Page 2 of 5

EXHIBIT A
(1 OF 3)

Formulas for Computing Unmeasured Gas Used or Lost

Emptying and Filling Lines

a) To determine the quantity of gas blown to atmosphere when the pressure in a section of pipeline is reduced from an initial pressure (P_1) to a final pressure (P_2).

$$V = 0.00545\ d^2\ L\ (F_{pm1} - F_{pm2})$$

b) To determine the quantity of gas blown to atmosphere when a section of pipeline is completely emptied (i.e., complete displacement by air or other medium) from an initial pressure (P_1).

$$V = 0.00545\ d^2\ L\ F_{pm1}$$

c) To determine the quantity of gas required to fill a pipeline section from an initial pressure (P_1) to a higher final pressure (P_2).

$$V = 0.00545\ d^2\ L\ (F_{pm2} - F_{pm1})$$

d) To determine the quantity of gas required to fill a pipeline section to a final pressure (P_2) when that section is completely empty (i.e., contains air at atmospheric pressure).

$$V = 0.00545\ d^2\ L\ F_{pm2}$$

The above formula is used to determine the gas required to fill a pipeline to a final pressure (P_2) following a purging operation in which gas is used to purge the air from the pipeline.

The following abbreviations are used in the formulas:

V	=	Quantity in standard cubic feet, of gas at assumed base conditions of 60° F temperature, 14.73 psia pressure, and 0.60 specific gravity.
d	=	Inside diameter of the pipeline, in inches.
L	=	Length of the pipeline, in feet.
F_{pm}	=	Pressure multiplier factor for the corresponding operating pressure
F_{pm1}	=	Pressure multiplier factor for the initial pressure (P_1)
F_{pm2}	=	Pressure multiplier factor for final pressure (P_2)

NOTE: These formulas are also applicable for propane in propane gas distribution systems, being limited to a minimum operating pressure of 30 psig for polyethylene pipe.

MiSource

Gas Standard

Distribution Operations

Effective Date: 11/05/2007	**Reporting Gas Used During Construction**	Standard Number: **GS 3000.920(CG)**
Supersedes: N/A		Page 3 of 5

EXHIBIT A
(2 OF 3)

TABLE 1 – Pressure Multiplier Table

Specific Gravity: 0.6

Pressure (psig)	F_{pm}	Pressure (psig)	F_{pm}	Pressure (psig)	F_{pm}
0	0.98	210	15.75	610	46.81
5	1.32	220	16.48	620	47.64
10	1.66	230	17.21	630	48.47
15	2.00	240	17.94	640	49.30
20	2.34	250	18.68	650	50.14
25	2.69	260	19.42	660	50.98
30	3.03	270	20.16	670	51.82
35	3.37	280	20.90	680	52.66
40	3.72	290	21.65	690	53.51
45	4.06	300	22.39	700	54.36
50	4.41	310	23.14	710	55.21
55	4.75	320	23.90	720	56.06
60	5.10	330	24.65	730	56.92
65	5.45	340	25.41	740	57.78
70	5.79	350	26.17	750	58.64
75	6.14	360	26.93	760	59.51
80	6.49	370	27.70	770	60.37
85	6.84	380	28.46	780	61.24
90	7.19	390	29.23	790	62.11
95	7.54	400	30.00	800	62.99
100	7.89	410	30.78	810	63.87
105	8.24	420	31.55	820	64.75
110	8.59	430	32.34	830	65.63
115	8.95	440	33.12	840	66.52
120	9.30	450	33.91	850	67.41
125	9.65	460	34.69	860	68.29
130	10.01	470	35.48	870	69.18
135	10.36	480	36.28	880	70.08
140	10.72	490	37.07	890	70.98
145	11.07	500	37.87	900	71.89
150	11.43	510	38.67	910	72.79
155	11.79	520	39.47	920	73.69
160	12.14	530	40.27	930	74.60
165	12.50	540	41.08	940	75.50
170	12.86	550	41.89	950	76.42
175	13.22	560	42.71	960	77.33
180	13.58	570	43.52	970	78.25
185	13.94	580	44.34	980	79.18
190	14.30	590	45.16	990	80.10
195	14.66	600	45.98	1000	81.03
200	15.02				

Table Derivation

$$F_{pm} = \frac{P_L + P_a}{P_b} \times (F_{pv})^2$$

Where:

F_{pm} = Pressure Multiplier

P_L = Line Pressure, psig

P_a = Atmospheric Pressure, 14.4 psia

P_b = Base Pressure, 14.73 psia

F_{pv} = Supercompressibility Factor @ Base Conditions of 14.73 psia, 60° F, and 0.6 SG

MiSource

Gas Standard

Distribution Operations

Effective Date: 11/05/2007	**Reporting Gas Used During Construction**	Standard Number: **GS 3000.920(CG)**
Supersedes: N/A		Page 4 of 5

EXHIBIT A
(3 OF 3)

TABLE 2 – MCF Volume of Gas In 1,000 Feet of Pipeline

Line Diameter (Inches)	Line Pressure (psig)			
	10 psig	50 psig	100 psig	500 psig
2	-	0.1	0.2	0.8
3	0.1	0.2	0.4	1.8
4	0.1	0.4	0.7	3.3
6	0.3	0.9	1.5	7.4
8	0.6	1.5	2.8	13.2
10	0.9	2.4	4.3	20.6
12	1.3	3.4	6.2	29.7
14	1.8	4.7	8.4	40.5
16	2.3	6.2	11.0	52.9
18	2.9	7.8	13.9	66.9
20	3.6	9.6	17.2	82.6

MiSource

Gas Standard

Distribution Operations

Effective Date: 11/05/2007	**Reporting Gas Used During Construction**	Standard Number: **GS 3000.920(CG)**
Supersedes: N/A		Page 5 of 5

EXHIBIT B

Form C-2378, "Estimate of Unmeasured Gas Used and Lost"

COLUMBIA GAS
Distribution Companies

ESTIMATE OF UNMEASURED GAS USED AND LOST

COMPANY	DISTRICT	PREPARED BY	DATE
☐ COH ☐ CKY ☐ CVA ☐ CHC ☐ CPA ☐ CNY ☐ CMD			

DATE OF USE		MAIN NO. (MARKET NO.)			USAGE DESCRIPTION	MCF
DAY	MO	CO.	MARKET	SYSTEM		

COMMENTS

FORM C 2378 CSD (6-87)

MiSource
Distribution Operations

Gas Standard

Effective Date: 03/01/2010	**Transmission Lines and Distribution Mains** **Repair of Steel Pipe**	Standard Number: **GS 3010.010**
Supersedes: N/A		Page 1 of 2

Companies Affected:

☑ NIPSCO Effective: 06/01/2012	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR 192.309

1. GENERAL

This Standard covers the repair of steel pipe during construction prior to it being placed in service. As used in this standard, a repair to steel pipe corrects pipe wall damage or imperfections to restore its intended serviceability.

Each steel pipe imperfection or damaged area that would impair serviceability must be repaired or removed. If neither action will return the pipe to its intended serviceability, then the length of pipe shall be rejected as not suitable for service.

See Gas Standard GS 3000.020, “Inspection of Materials” for details on surface imperfections and damage that would impair serviceability.

Rejected steel pipe must be reported as failed material in accordance with Gas Standard GS 1652.010, “Investigation of Failures.”

1.1 Dents

Each of the following dents must be removed from steel pipe to be operated at a pressure that produces a hoop stress of 20 percent or more of SMYS, unless the dent is repaired by a method that reliable engineering tests and analyses show can permanently restore the serviceability of the pipe:

1. a dent that contains a stress concentrator such as a scratch, gouge, groove, or arc burn,
2. a dent that affects the longitudinal weld or a circumferential weld, or,
3. in pipe to be operated at a pressure that produces a hoop stress of 40 percent or more of SMYS, a dent that has a depth of:
    a. more than 1⁄4 inch (6.4 millimeters) in pipe 12-3⁄4 inches (324 millimeters) or less in outer diameter; or
    b. more than 2 percent of the nominal pipe diameter in pipe over 12-3⁄4 inches (324 millimeters) in outer diameter.

1.2 Arc Burns

Each arc burn on steel pipe to be operated at a pressure that produces a hoop stress of 40 percent or more of SMYS must be removed or repaired.

2. STEEL PIPE REPAIR

2.1 Repairs to Damaged or Imperfection Areas

If a repair is made by grinding, the remaining wall thickness must at least be equal to either:

1. the minimum thickness required by the tolerances in the specification to which the pipe was manufactured, or
2. the nominal wall thickness required for the design pressure of the pipeline.

When repairing an arc burn by grinding, it must be completely removed. The ground area can be swabbed with 20 percent solution of ammonium persulfate. A blackened spot will indicate that additional grinding is necessary. The complete removal of the metallurgical notch created by the arc burn has been accomplished when the swabbing does not result in a blackened spot.

A gouge, groove, arc burn, or dent may not be repaired by insert patching or by pounding out.

2.2 Removal of Damaged or Imperfection Area

Each gouge, groove, arc burn, or dent that is removed from a length of pipe must be removed by cutting out the damaged portion as a cylinder.

3. COATING REPAIR

Damaged coating shall be repaired according to Gas Standard GS 1420.040, “Repair Methods for Mill Applied Coatings” and/or other applicable Gas Standards.

4. RECORDS

Rejected pipe shall be returned as defective or accounted for as scrapped according to the Company’s material accounting procedures.

Where a repair is made that reduces the pipe wall thickness to less than the nominal thickness of the length, the information shall be communicated to Field Engineering for determination of adequate design pressure, and the information shall be noted in the work completion report.

NiSource

Gas Standard

Distribution Operations

Effective Date: 03/01/2010	**Transmission Lines and Distribution Mains** **Repair of Plastic Pipe**	Standard Number: **GS 3010.020**
Supersedes: N/A		Page 1 of 1

Companies Affected:

☑ NIPSCO Effective: 06/01/2012	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR 192.311

1. GENERAL

This Standard covers the repair of plastic pipe during construction prior to being placed in service. As used in this standard, repair means any action performed on the pipe so that it can meet its intended serviceability.

Each imperfection or damage that would impair the serviceability of plastic pipe must be removed. Types of pipe damage include:

a. a cut or scratch having a depth of 10% or more of the pipe wall thickness, and

b. a kink or buckle.

The damaged portion of pipe must be removed as a cylinder. The remaining pieces can then be re-joined by the appropriate method.

Joining must be performed in accordance with the Joining Manual standards and the Company's Operator Qualification Plan.

2. RECORDS

Rejected pipe shall be accounted for according to the Company's material accounting procedures.

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Gas Standard

Distribution Operations

Effective Date: 03/01/2010	**Transmission Lines and Distribution Mains** **Bends and Elbows**	Standard Number: **GS 3010.030**
Supersedes: N/A		Page 1 of 3

Companies Affected:

☑ NIPSCO Effective: 06/01/2012	☑ CGV ☑ CKY ☑ CMA	☑ CMD ☑ COH ☑ CPA

REFERENCE 49 CFR 192.313

1. GENERAL

This standard applies to bends made in steel pipelines.

Minor directional changes in pipelines may be made by field bending or with fittings.

The pipe bends shall:

a. not impair the serviceability of the pipe, and

b. be free from buckling, cracks, thinning of the pipe wall, or any other evidence of mechanical damage.

2. BENDING REQUIREMENTS

Field bends of steel mains shall be made by the cold bending methods that result in a smooth uniform bend.

The maximum deflection permitted in cold bends of steel pipe depends upon the diameter and wall thickness of the pipe. In no case shall the longitudinal axis of the pipe be permanently deflected more than:

a. for pipe 10" or less in nominal diameter, five degrees in any length along the pipe axis equal to the diameter of the pipe, or

b. for pipe 12" and larger in nominal diameter, one and one-half degrees in any length along the pipe axis equal to the diameter of the pipe.

Where the necessary overall deflection does not require the use of a fitting but exceeds the limitation for an individual bend, a number of individual bends may be required.

Wrinkle bends are prohibited in all steel pipe installations.

The minimum distance between the bend and the closest end of the pipe joint measured along the longitudinal axis of the pipe shall be no less than 1 1/2 pipe diameters or the

limitation of the bending equipment, whichever is greater. In all cases, suitable precautions shall be taken to prevent out-of-roundness at the end of the pipe joint due to the bending action.

No bends shall be permitted to occur at pipe end welds, nor shall a weld come in contact with the surface of the bending or holding shoe, or clamp of the bending machine.

Where welded seam pipe is used, the longitudinal seam shall be placed in the neutral axis (i.e., on top of side bends, and for pipe over 12 inches on the side for sag bends and over bends).

Each circumferential weld of steel pipe (butt weld) which is located where the stress during bending causes a permanent deformation in the pipe must be nondestructively tested, either before or after the bending process.

Bends shall be made to conform to the profile of the bottom of the completed trench. Bends that are determined, by the person in charge, to be unsatisfactory because of distortion, buckling, or other defect, shall be removed from the line and replaced with a proper bend or other means to accomplish the minor directional change.

For information on mitered joints, see the applicable Company Welding Manual or standard.

3. BENDING FOR TRANSMISSION LINES

The hydraulically-operated bending machine's operating procedure shall be followed for bending pipe when installing transmission lines that are owned by the Company. Table 1 contains the required data to properly perform the bend by pipe size.

Table 1 - Pipe Bending Data

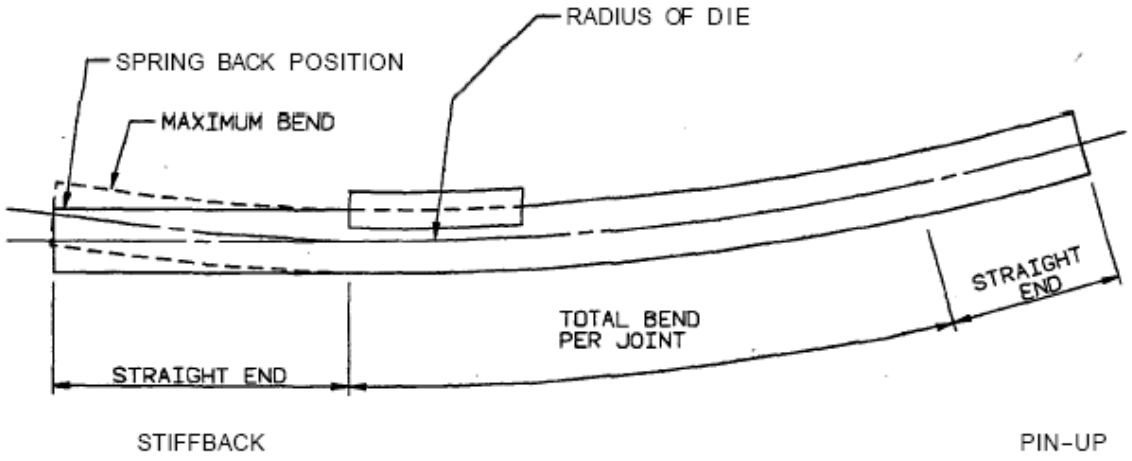
Pipe Nominal Diameter [IN]	Die Radius [FT-IN]	DEGREE PER ARC FOOT *	ACTUAL BEND PER ARC FOOT	ACTUAL BEND PER 40 FEET
16	26-8	2.14°	1.2°	32.4°
20	33-4	1.70°	0.9°	24.4°
22	36-8	1.56°	0.8°	21.6°
24	40-0	1.42°	0.75°	20.2°
30	50-0	1.12°	0.6°	16.2°
36	60-0	0.96°	0.5°	13.5°

* This column is the curvature in the die. This exceeds the possible bend of most pipe sizes.

The following Sketch 1 illustrates some of the terms used in bending. It also shows the straight ends of the pipe that are in the stiffback, or pin-up shoe, when starting and finishing a bend.

Effective Date: 03/01/2010	Transmission Lines and Distribution Mains **Bends and Elbows**	Standard Number: **GS 3010.030**
Supersedes: N/A		Page 3 of 3

Sketch 1 – Result of Pipe Bending



4. RECORDS

4.1 Company Forms/Database

The acceptance of bends is included in the job inspection or work documentation.

The location and angle of each field bend shall be recorded in the work completion report.

4.2 Records Retention

All records of bends shall be kept for the life of the pipeline.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Transmission Lines and Distribution Mains** **Protection from Hazards**	Standard Number: **GS 3010.040**
Supersedes: 03/01/2010		Page 1 of 6

Companies Affected:

☑ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR 192.317

1. PLANS

The Company must take all practicable steps during construction to provide protection for each new and replacement transmission line or distribution main from:

a. washouts,
b. floods,
c. unstable soil,
d. landslides, or
e. other hazards that may cause the pipeline to move or to sustain abnormal loads.

Each aboveground transmission line or distribution main, not located in inland navigable water areas, must be protected from accidental damage by vehicular traffic or other similar causes, either by being placed at a safe distance from the traffic or by installing barricades.

2. NATURAL HAZARDS

Reasonable precautions (such as increasing the wall thickness, constructing revetments, preventing erosion, installing anchors, and providing flexibility) should be taken to protect the pipe.

Where transmission lines or mains cross areas that are normally under water or subject to flooding (such as lakes, bays, swamps, and river crossings), sufficient weight or anchorage should be applied to the line to prevent flotation. This may include areas behind protected levees and areas seaward of floodgates.

For underwater crossings that may be subject to washout due to the natural hazards of bed changes, high water velocities, deepening of the channel, or changing of the channel location in the bed, attention should be given to designing protection for the transmission line or main. The crossing should be located in the more stable bank and bed locations. The depth of the line, location of the bends installed in the banks, and the wall thickness of the pipe should be selected based on the characteristics of the crossing.

Where transmission lines or mains cross areas that are not normally under water, but are

subject to periodic run-off, the depth should be sufficient to protect the pipeline from expected scour (washout), such as that expected from a 100-year flood. Concrete coating, protective mats, or other means can be used to protect the pipeline from damage that may result from scouring action.

Access to isolation valves should be designed considering water elevations during a 100-year flood event. This can be accomplished by placing the valves above the 100-year flood elevation, behind levees, or by using valve extensions and access platforms.

3. OUTSIDE FORCES

The following measures should be considered to minimize damage by outside forces.

3.1 Design

3.1.1 Selecting pipe locations

To provide better control over future construction activities, consideration should be given to installing facilities in a private right-of-way.

Where practicable, facilities in a street should be installed at a constant distance from the property line. Diagonal installations or installations which "wander" in the street or right-of-way should be avoided.

Where it is economically feasible, parallel main installations on each side of a street should be considered to avoid crossing the street. Protective sleeves or bridging should be considered for PE piping in addition to providing adequate backfill and compaction to reduce excessive bending and shear stresses. Protective sleeves are designed to mitigate the stresses imposed on the PE pipe due to earth settlement where other utility crossings are made beneath PE piping. Without bridging or a protective sleeve, earth settlement beneath the existing PE piping may cause a downward bow of the PE piping resulting in stress concentrations at the edges of the excavation area.

The installation of facilities should be avoided in areas where storm sewer lines or catch basins are likely to be installed.

The probable pattern of future land use should be considered in selecting the route for new pipelines.

3.1.2 Cover

Additional cover beyond the minimum requirements (see GS 3010.090 “Cover”) should be provided where the potential for damage by outside forces is greater than normal. Consideration should be given to the following.

a. Agricultural land where deep plowing equipment or sub-pan breakers are used.

b. Agricultural land where the grade may be changed to permit irrigation or drainage.

c. Drainage ditch crossings. Consideration may also be given to alternates such as casing or a protective concrete or steel slab.

d. Other utility crossings. The new gas facilities should be installed under the existing facilities unless adequate cover can be provided, or casing, bridging or other protection is used.

e. Locations where erosion due to wind, water or vehicular activity may affect the grade. Riprap, paving or some other means of protection may be used in lieu of additional cover.

f. Street locations where future street work is a possibility.

3.1.3 Landfills and unstable soil

Special consideration should be given when placing pipelines over landfill areas where the supporting fill may decompose. Mitigation measures include extra excavation and soil replacement or additional pipe support such as slabs or casings.

Long-wall or other mining underneath a pipeline may also lead to pipeline undermining or lack of support. Additional pipeline thickness, support bridging or slabs, or casings are all methods for consideration to mitigate these conditions.

Areas subject to salt mining or sinkholes also deserve special consideration and may warrant one or more of the above solutions.

3.2 Line Markers

Consideration should be given to installing line markers beyond the requirements (see GS 1720.010 “Line Markers for Mains and Transmission Lines”) where the risk for pipeline damage could be reduced.

3.3 Mining Activities

An operator should consider the effects of mining activities on pipeline facilities. The ground subsidence and soil overburden can cause significant stresses in pipelines.

Long-wall mining is of special concern to pipeline operators. Long-wall mining involves complete removal of a coal seam that is typically 200 to 1500 feet underground. The roof of the mine collapses, and the collapse propagates to the surface.

Operators with pipelines in areas of mining activity should consider the following actions.

1. Contact the mine operator to obtain the depth of coal, mined height, width of the seam, location and angle at which the activity passes under the pipeline, estimated schedule of mining activities, and previous subsidence profiles for other mines in the area.
2. Review the material properties of the pipe and associated valves and fittings, such as specification, rating or grade, wall thickness, SMYS, toughness, and seam and joint characteristics.
3. Perform subsidence calculations to predict the effect on the pipeline. One method of predicting subsidence was developed by the National Coal Board (NCB) and is reported in the "Subsidence Engineers Handbook."
4. Reduce operating pressure or remove pipeline from service if warranted by predicted stress levels.
5. Expose the pipeline to limit overburden stress.
6. Monitor subsidence and strain levels. A reference for monitoring subsidence is PRCI L51574, "Nonconventional Means for Monitoring Pipelines in Areas of Subsidence or Soil Movement," NG-18 Report No. 166.

3.4 Damage Prevention Considerations for Trenchless Technology

See GS 1100.050 “Damage Prevention Using Trenchless Technology” for damage prevention considerations while performing directional boring or using other trenchless technologies.

3.5 Other Means for Protection

Consideration should be given to incorporating the following measures.

a. Use special precautions to protect buried control lines.

b. Install small-diameter, service line taps so that the top of the tee is lower

than the top of large diameter pipe.

c. Use colored pipe wrap or coating so that the content of a pipe is readily evident, especially for aboveground piping. This coloring should conform to American National Standards where applicable.

d. Where a plastic pipeline is installed in a common trench with electric underground lines, install it with additional clearance (beyond that given in GS 3010.080 “Underground Clearance”) to prevent damage to the gas line from heating, a fault in the power line, or excavating the power line.

e. For aboveground facilities, there is a potential for damage due to traffic, vandalism or other causes. Areas of review include proximity to streets and highways, type of vehicular traffic and existing or expected future traffic patterns. Where unusual hazards may reasonably be expected, precaution should be taken to guard against them (such as guards, locks, protective barriers or even an alternative or underground location).

f. Respond to requests from third-party designers or planners for information regarding location of buried facilities. Such responses may include the following:

    a. providing maps,

    b. holding meetings, or

    c. locating facilities in the field.

Recipients of such information should be reminded that notice of intent to excavate must still be provided in accordance with state or local regulations.

For specific blasting considerations, refer to GS 1100.020 “Blasting Activities.”

4. EXTERNAL CORROSION FROM STRAY ELECTRICAL CURRENTS

Attention should be given to a new pipeline's physical location, particularly if the location may subject the pipeline to stray electrical currents from other facilities, such as the following.

1. Other pipelines or utilities with associated cathodic protection systems.
2. Rail transit systems.
3. Mining or welding operations.
4. Induced currents from electrical transmission lines.

To the extent possible, the Company should identify and plan for the mitigation and control of anticipated stray electrical currents prior to construction. Refer to GS 1420.100 “Corrosion Control Design – Stray Currents” for guidance. As soon as practicable after

construction of the pipeline or facility to be protected is completed, the Company should implement monitoring, testing, and mitigation plans to control the effects of stray electrical currents. The rate of corrosion caused by stray electrical current can be higher than the rate of corrosion resulting from galvanic action.

Once the interference control methods have been established, periodic tests and inspections should be conducted to ensure their continued effectiveness.

5. RECORDS

The location of facilities should be accurately mapped or otherwise recorded. The Company should ensure that maps or records used for locating facilities are updated whenever any changes are made.

NiSource
Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Transmission Lines and Distribution Mains**	Standard Number: **GS 3010.050**
Supersedes: 01/01/2012	**Installation of Pipe in a Ditch**	Page 1 of 9

Companies Affected:	☐ NIPSCO	☑ CGV	☑ CMD
		☑ CKY	☑ COH
		☐ CMA	☑ CPA

REFERENCE 49 CFR 192.319

1. GENERAL

This standard applies to the installation of transmission lines and distribution mains (pipelines) into a ditch (open trench). See GS 3010.060 "Installation of Plastic Pipe" for specifics to plastic piping installations.

On steel pipelines operating at stresses of 20 percent or more of the specified minimum yield strength (SMYS), it is important that stresses induced into the pipeline by construction, such as when lowering the pipe into the trench, be minimized.

The Company's Representative, whether employee or contractor:

a. shall inspect each project/job site to ensure that all work complies with Company procedures and is done in accordance with all governmental regulations; and

b. has the authority to order the removal or correction of any portion of construction, welds, fusions, mechanical joints, coatings, backfill, etc. that do not meet the Company's requirements.

2. PLACEMENT IN THE DITCH

Open trenching, also called direct burial, is a method by digging a trench (ditch) down into the soil, placing the pipe in the trench, and backfilling the trench. This method has the advantage of placing the pipe in nearly ideal buried conditions. The disadvantages of this method are: 1) having to remove hard surfaces, and 2) the required surface restoration.

When installing mains by excavating a ditch (open trench), the ditch width is recommended according to Table 1.

Table 1

Nominal Pipe Diameter [in.]	Recommended Ditch Width [in.]
2	4
3	6
4	8
6	12
8	14
10	18
12	24
16	24
20	30
22	32
24	36

The condition of the ditch bottom should be inspected just before the pipe is lowered into it. The bottom of the trench shall be graded to provide a smooth continuous bearing surface for the pipe. Sufficient loose earth shall be left in the trench to form a bed for the pipe. The bottom must be free from objects that could damage the piping, either during installation or from subsequent anticipated soil movement.

The pipe should fit the ditch without the use of external force to hold it in place until the backfill is completed. Periodic placement of sandbags, styrofoam benches, etc., along the bottom of the ditch is one effective means of providing firm support and minimizing construction stresses. The fit of the pipe to the ditch should be inspected before backfilling.

When long sections of pipe that have been welded alongside the ditch are lowered into it, or where excessive depths are encountered, care should be taken to avoid jerking the pipe or imposing any strains that might kink or put a permanent bend in the pipe. Where these conditions are encountered, the use of slack loops should be considered.

3. MECHANICAL FITTING JOINT RESTRAINT

Suitable harnessing or buttressing (i.e., strapping or blocking) should be provided at points where the pipe deviates from a straight line and the thrust, if not restrained, would separate the joints.

Refer to the manufacturer’s fitting specifications to determine if joint restraint is required.

Refer to GS 1320.010 “Mechanical Coupling Connections” for further guidance.

4. BACKFILLING

Backfilling should be performed in a manner to provide firm support under the pipe. Where rock is encountered, a minimum of four (4) inches of earth padding or other suitable special backfill shall be placed in the bottom of the trench.

Backfilling shall follow the laying and lowering of the main as soon as practical to provide protection to the pipe and minimize the amount of time the ditch is left open for related hazards.

Backfilling shall be done by methods that provide desired compaction, and in accordance with all requirements of local governmental authorities. Some agencies may require special fill. Where conditions permit (e.g., cross-country work, etc.), the backfill material may be heaped over the center of the trench, so as to ensure complete filling of the trench after settlement.

4.1 Backfill Material

Native material from excavations may be used as backfill provided that all organic material, rubbish, debris, and other objectionable material are first removed.

Excavated rocks with a dimension not larger than 6 inches may be returned to the trench, but care should be used to prevent damage to the pipe or coating. The rocks shall be prevented from contacting the pipe by the use of rock shield, or by an initial fill of rock-free earth padding of not less than four (4) inches around the entire pipe circumference.

In cultivated fields or fields suitable for cultivation, rocks shall be covered with at least 12" of soil.

Consideration should be given to the possible shielding effects on cathodic protection currents for steel pipelines that may occur from the installation of non-conductive materials such as rock shielding and padding.

4.2 Rock Shielding

Where rock shielding is used to prevent pipe or coating damage, it must be installed properly. One method of installing a wrap-type rock shielding material is to secure the rock shielding entirely around the pipe using fiberglass tape or other suitable banding material. Rock shielding should not be draped over the pipe unless suitable backfill and padding is placed in the ditch to provide continuous and adequate support of the pipe in the trench.

4.3 Compaction

All openings in traffic areas of streets, alleys, and road berms shall be compacted by tamping. Pneumatic, hydraulic, or mechanical tampers may be used, provided care is taken so as not to damage adjacent water, gas, electric, sewer or other facilities. Compacting backfill by rolling with equipment is acceptable, providing the backfill is a granular (sand or gravel) type, and the method is approved by the person in charge. Tampers shall not be allowed to come in contact with the pipe or any connections on the pipe systems being installed.

Heavy rollers, tractor wheels and large mechanical tampers, such as hydrohammers, should only be used when there is a minimum of 24" of cover that has been inspected for rocks and debris that could concentrate loading on the pipe. Backhoes shall not be used for tamping, but equipment attached to backhoes designed for tamping may be used.

4.4 Consolidation

Consolidation of backfill shall not be performed by trench flooding. Other suitable means for backfill compaction listed in Section 4.3 shall be used.

4.5 Warning Tape

Warning tape shall be installed on all open cut portions of pipeline installations.

The warning tape should be installed approximately 6" to 12" below the planned final grade. It can be installed during the backfill operation or by plow-in method after the backfill operation is completed.

5. PROVIDING FOR LOCATING

Steel pipelines and facilities are normally located conductively by corrosion testing leads, or inductively by placing the locate equipment transmitter directly over the pipeline.

Plastic pipelines and facilities are normally located conductively by a tracer wire. GS 3010.060 “Installation of Plastic Pipe” for tracer wire requirements.

Upon completion of the new or replacement pipeline installation, the entire pipeline installation shall be located with appropriate markings and stakes/flags by the Company or Company’s contracted personnel according to GS 1100.010(MD), GS 1100.010(KY), GS 1100.010(OH), GS 1100.010(PA), or GS 1100.010(VA) “Locating Gas Facilities.”

The installation of temporary or permanent line markers should be considered if active construction (i.e., Company or 3rd party) is occurring in the area. Examples of construction

activities to consider include the following.

a. Road improvement projects where Company facilities do not require relocation.

b. Road improvement projects where the Company has relocated facilities for the project.

c. New business projects where other utilities are expected to construct facilities after the Company's installation has been completed.

Refer to the applicable GS 1720.010 “Line Markers for Mains and Transmission Lines” for guidance and/or requirements.

5.1 Criteria for Placing Electronic Markers

The installation of electronic markers shall be considered to provide a means to locate accurately pipelines that are difficult to locate by other means, and to locate certain pipeline features. Electronic markers should be installed at:

a. segments of the pipeline deeper than 15 feet,

b. connections of segments installed on different work orders,

c. end of line locations,

d. casing ends,

e. point features, such as stopple fittings and drips, and

f. other situations where it is known that a facility is difficult to locate.

5.2 Electronic Marker Installation

Electronic markers shall be installed per the manufacturer’s instructions.

Electronic markers also shall be installed per the following conditions.

a. Markers should not be placed within 6 inches of known metallic structures such as metallic valve boxes or metallic conduit.

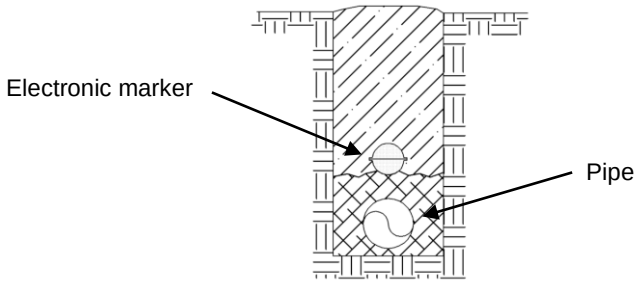
b. Where markers are employed to locate valves, the markers shall be installed one (1) foot north or west of the valve, over the main line.

c. Markers should be installed above the pipeline or features at the top of the bedding material, as shown in Figure 1.

d. Markers should not be installed at a depth below anticipated finished grade greater than 36 inches.

e. Care must be taken when backfilling to prevent changing the location of the marker.

Figure 1 – Installation of Electronic Markers in a Trench



6. RECORDS

All applicable Company information for the installation of pipe shall be recorded in the work completion records for updating databases, maps, etc., and retained as required by the work completion process.

In addition, specific installation field measurements by swing ties (from 2 fixed objects) shall be recorded for:

a. control fittings (e.g., Shortstopp, valve),

b. end of line locations,

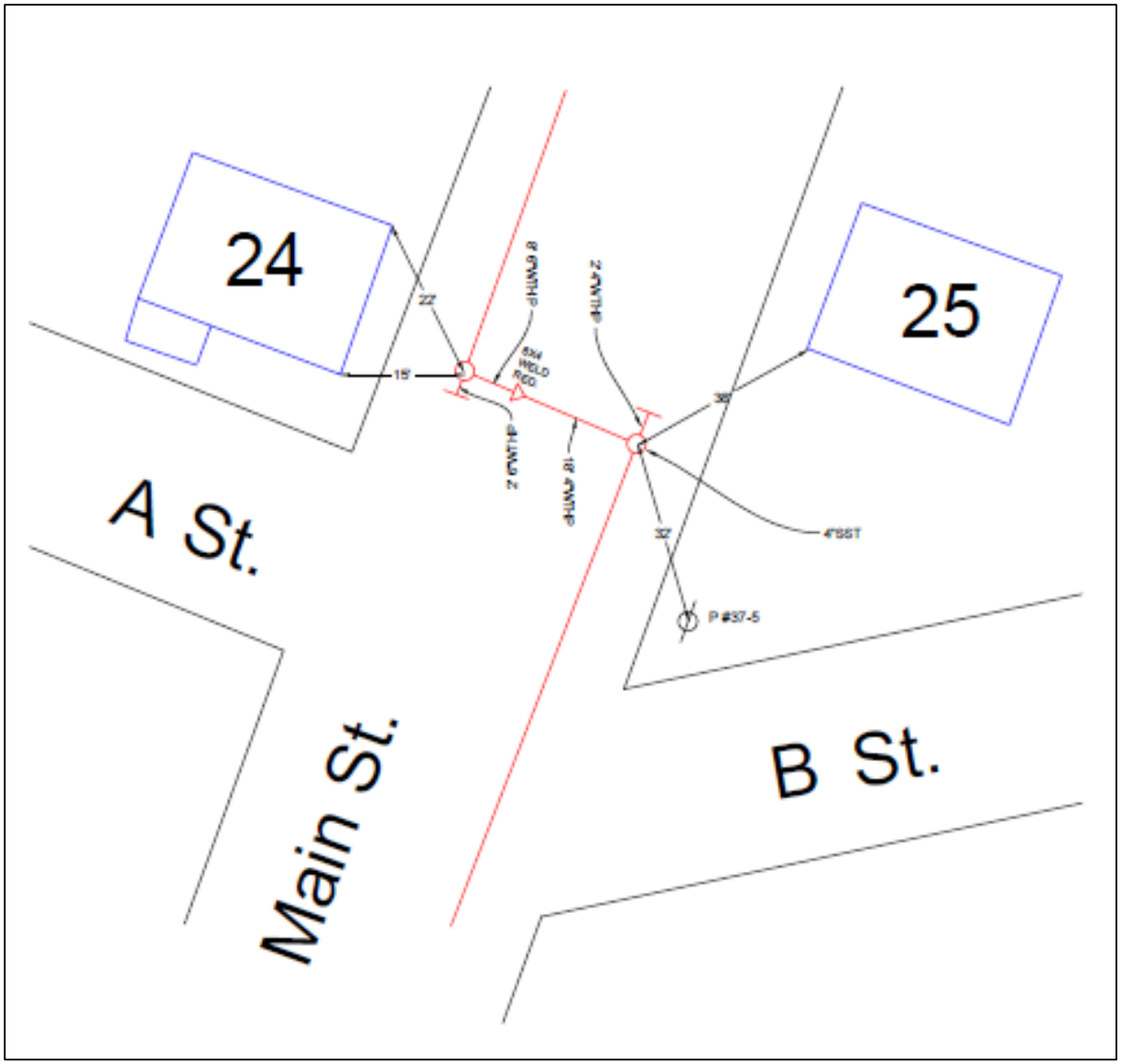
c. changes of direction (by fittings), and

d. material transition fittings (metallic to plastic changes.)

In congested areas, such as tie-in locations, point-to-point measurements between fittings, is permissible in place of individual swing tie measurements to each fitting when the length of pipe between fittings is 10 feet or less. However, at least one fitting within the congested area must have field measurements by swing ties (from 2 fixed objects). See Exhibit A for examples of correct swing-tie measurements. Exhibit B is an example of incorrect swing-tie measurements.

EXHIBIT A
(1 of 2)

Correct Swing-Tie Measurements



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Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Transmission Lines and Distribution Mains** **Installation of Pipe in a Ditch**	Standard Number: **GS 3010.050**
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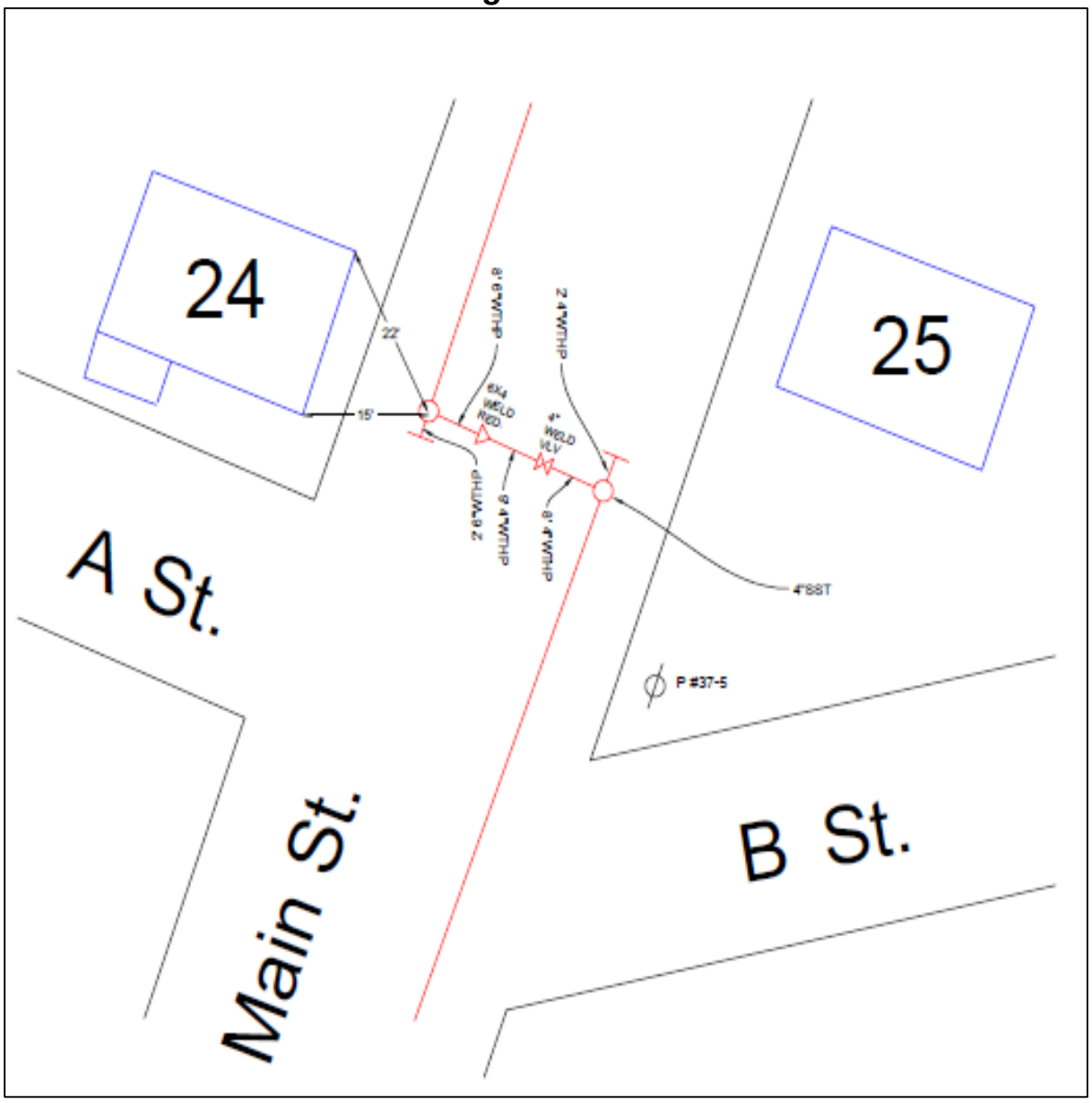
EXHIBIT A
(2 of 2)

Correct Swing-Tie Measurements



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Effective Date: 01/01/2016	**Transmission Lines and Distribution Mains** **Installation of Pipe in a Ditch**	Standard Number: **GS 3010.050**
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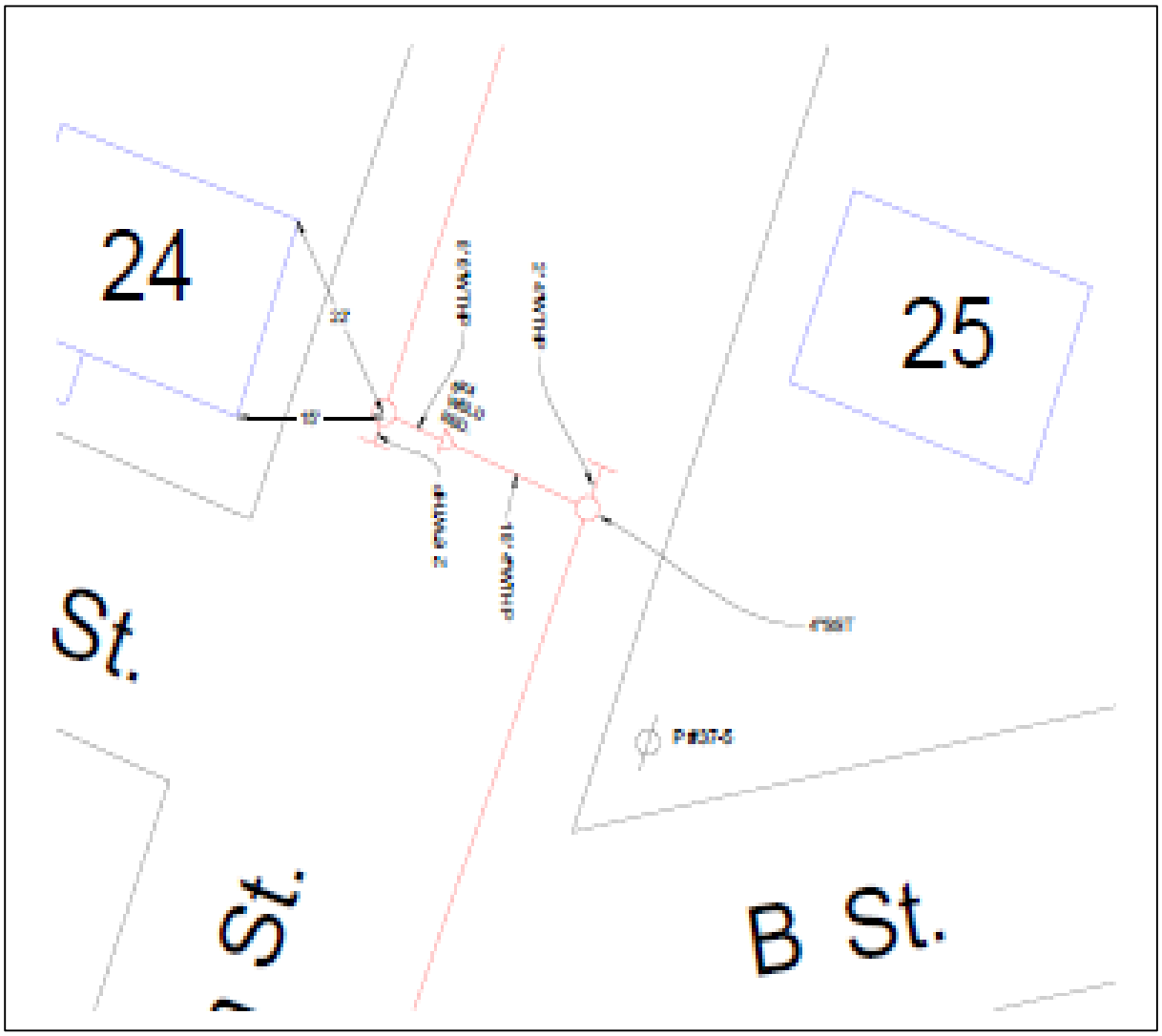
EXHIBIT B

Incorrect Swing-Tie Measurement



Note: This drawing is incorrect because the distance between the weld reducer and the 4 inch shortstop is greater than 10 feet therefore a swing-tie measurement for the 4 inch shortstop is needed.

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Distribution Operations

Gas Standard

Effective Date: 01/01/2016	**Transmission Lines and Distribution Mains** **Installation of Plastic Pipe**	Standard Number: **GS 3010.060**
Supersedes: 04/01/2013		Page 1 of 8

Companies Affected:

☐ NIPSCO	☑ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE 49 CFR 192.321

1. GENERAL

This standard provides specific details for the installation of polyethylene plastic piping for transmission lines and distribution mains. See Gas Standards:

GS 3010.050, “Installation of Pipe in a Ditch” for general details;
GS 3010.070 or GS 3010.070(MA), “Casing”;
GS 3010.100, “Trenchless Technology”;
GS 3010.102, “Horizontal Boring”;
GS 3010.104, “Augering with Casing”; and
GS 3010.106, “Other Boring Methods.”

Plastic pipe that is older than 24 months shall not be installed unless it has been tested for deterioration and found acceptable within 90 days prior to installation. See Gas Standard GS 3000.020, “Inspection of Materials” for deterioration testing requirements.

Plastic pipe shall only be installed below ground, except as permitted for temporary above ground installations (see Section 4) and bridge crossings (see Section 5).

All plastic pipe that is installed in a vault or other below ground enclosure must be encased in gas-tight metallic pipe and fittings, adequately protected from corrosion.

Plastic piping shall be installed in a manner to minimize shear and tensile stresses.

The shortest section of plastic pipe that is permitted to be installed between metallic mains is 5 feet. This limitation applies for either a short replacement, such as for leakage, or for the purpose of providing corrosion control insulation.

When not encased, the minimum wall thickness of polyethylene pipe is 0.090 inch, unless the outside diameter is less than 7/8 inch (0.875”), then the minimum is 0.062 inch.

All plastic fusion joining shall be performed by a qualified individual according to the Company’s applicable Joining Manual fusion procedures.

The Company’s Representative, whether employee or contractor:

a. shall inspect each project/job site to ensure that all work complies with Company procedures and is done in accordance with all governmental regulations; and

b. has the authority to order the removal or correction of any portion of construction, welds, fusions, mechanical joints, coatings, backfill, etc. that do not meet the Company's requirements.

2. INSTALLATION METHODS

2.1 Open Trenching

2.1.1 Pipe Installation

The pipe must be lowered into the trench in a manner that minimizes stresses that could buckle the pipe or damage a fusion joint. This can be accomplished by lowering longer sections at multiple points along the pipe.

When placing the pipe in the trench, ample pipe should be installed, generally by “snaking” the pipe back and forth along the length, to allow for contraction. After placing the pipe in the trench, it should be allowed to stabilize to the ground temperature before tying it into existing pipelines.

Polyethylene plastic pipe has a thermal contraction rate of approximately 1 inch per 10 deg. F decrease per 100 feet of pipe.

2.1.2 Bending

Directional changes in plastic pipelines may be made by bending or with fittings. Excessive bending and pipe deflection shall be avoided.

The pipe bends shall:

a. not impair the serviceability of the pipe;

b. be free from buckling, cracks, thinning of the pipe wall, or any other evidence of mechanical damage.

Where bending and pipe deflection is required, the minimum bending radii are given in the following Table 1.

Table 1 – Minimum Bending Radii

Nominal Pipe Diameter [in.]	Mains containing fusion joints * [ft.]	Mains without fusion joints ** [ft.]
2	25	5
3	37	8
4	47	10
6	69	14
8	90	18

* 125 x OD (outside diameter in feet) for mains containing fusion joints (butt, socket, saddle and electrofusion) or mechanical fittings within the bend radius.

** 25 x OD (outside diameter in feet) for mains without fusion joints or mechanical fittings within the bend radius.

2.2 Boring

Refer to Gas Standards GS 3010.100, “Trenchless Technology,” GS 3010.102, “Directional Boring,” and GS 3010.106, “Other Boring Methods” for boring procedures.

A “weak link” shall be used when pulling 100 feet and greater of plastic piping so that the pipe and joints are not overstressed. On shorter pulls, a weak link should be considered. The weak link must be fused between the pulling head and the plastic pipe to be pulled. It shall be plastic pipe of the same material to be pulled and shall be the next commercially available diameter smaller than the diameter of the pipe to be pulled.

The Company Representative should be observant for conditions that could impose excessive drag, such as unstable soil, short radii direction changes, etc.

2.3 Plowing

The maximum length of plastic pipe, which may be pulled as a section, is 1000 feet. Couplings and collars are not permitted in the pipe to be pulled.

An investigation shall be made of the soil through which the pipe is to be pulled. The pull-in technique shall not be used if there is evidence of rock which is likely to cause severe scratching of the pipe or sandy type soil which could collapse the bore hole and bind the pipe.

The plow head shall be at least two (2) inches in diameter or one nominal pipe diameter larger than the diameter of the pipe to be pulled-in, whichever is the larger.

A weak link must be fused between the plow and the plastic pipe to be pulled-in. Refer to the weak link requirements in Section 2.2.

During the time the pipe is being pulled, vehicles or equipment shall not be permitted on the ground surface above the pipe.

In order to allow for contraction, a minimum period of twelve hours must elapse between the time a plastic pull-in is completed and the time the tie-in is made to the existing piping system. An overlap of approximately 2 feet for each 100 feet of pipe plowed should be left to allow for contraction.

2.4 Inserting in Casing

Refer to Gas Standard GS 3010.070, “Casing” for further requirements.

Plastic pipe that is being encased must be inserted into the casing pipe in a manner that will not impair the serviceability of the pipe. The leading end of the plastic must be closed before insertion. If possible, a metallic fitting is recommended for the purpose.

Plastic mains shall not be inserted in above ground casing except when installed for bridge crossings in accordance with Section 5.

There must be at least 24" of cover over lines used as casing. The Engineering Manager may authorize an exception to this requirement, so long as such authorization is documented stating the reason for the exception and that provisions for withstanding external loads are made. This documentation shall be filed with the project.

When service line connections can be anticipated on pipe to be inserted, casing windows may be provided prior to insertion to accommodate service line installations. When windows were not provided, they may be made after insertion using an axial (window) pipe cutter to prevent damage to the carrier pipe.

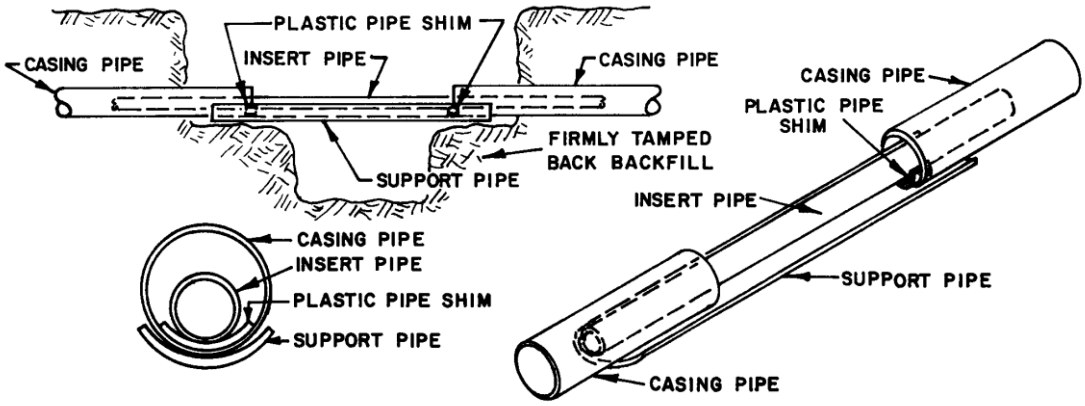
Visible projections or abrasive material, which could damage the plastic pipe during and after insertion, shall be removed from the casing pipe. This may be accomplished by pigging and/or reaming the casing pipe. Casing pipe ends shall be prepared using a pipe reamer, grinder, or round file, and may be covered by a suitable casing end protector.

After insertion, at least 5 feet of the leading end of the inserted plastic pipe shall be visually inspected for any damage (gouges, grooves, kinks, etc.) that could impair the serviceability of the pipe. If damage is found, all of the inserted plastic pipe shall be removed and inspected according to Gas Standard GS 3000.020, “Inspection of

Materials" and any damage corrected according to Gas Standard GS 3010.020, "Repair of Plastic Pipe."

Plastic pipe shall be continuously supported on solid ground where it enters and leaves the casing pipe.

That portion of the plastic piping exposed by the removal of a section (cylinder) of the casing pipe shall be continuously supported by bridging or compacted soil to prevent shearing. In the case of small gaps, the shim should extend from one casing pipe to the other, to provide continuous support.



The inserted plastic shall be allowed sufficient time to stabilize its temperature for expansion/contraction. After temperature stabilization, all casing openings (i.e., ends and windows) shall be sealed with foam to prevent water intrusion. The piping can then be tied into existing pipes.

Restraint of an inserted plastic main shall be provided to ensure adequate resistance to pull-out forces at tie-ins to metallic mains. This shall be accomplished by the placement of "anchor clamps" against the casing pipe or by other positive means to provide reinforcement of the joint where welding and/or fusion is not used.

3. PROVIDING FOR LOCATING

Plastic pipe that is not encased must be installed with an electrically conducting wire or other means of locating the pipe while it is underground. The preferred means for providing for pipe locating of non-cased plastic pipe is by the installation of a Company-approved, insulated and conductive solid tracer wire Other methods may be used, such as burying electronic (signal) markers above the pipe, where the use of tracer wire is not effective or practical.

3.1 Inserting Tracer Wire

Where nonmetallic plastic pipe is encased in metallic conduit, one of the two following methods shall be used to provide a means for locating the plastic pipeline.

a. Insert tracer wire with the plastic pipe into the metallic conduit if there is ample space within the conduit to avoid damage to the tracer wire or its protective coating. If the service line is connected to a plastic main, then the service line tracer wire shall be connected to the main tracer wire. If the service line is connected to a metallic main, then the service line tracer wire shall not be connected to the metallic pipeline.

b. Insert plastic pipe without the tracer wire into the metallic conduit. Locations where the remaining conduit has been separated shall be bonded across the cut sections to maintain continuity for locating purposes. In no case shall the bond wire be attached to, or allowed to come in contact with, in-service metallic piping or nonmetallic piping's tracer wire. A preferred option to maintain continuity for locating purposes is to cad-weld the bond wire across the cut-out sections of the casing, as long as the cad-welds are completed prior to the insertion of the plastic pipe to avoid heat damage. If the plastic pipe has already been inserted into the casing, then the bond wire should be connected to the casing by a mechanical wire clamp.

3.2 Tracer Wire

Tracer wire may not be wrapped around plastic pipe, and contact with the pipe must be minimized but is not prohibited. Tracer wire or other metallic elements installed for pipe locating purposes must be resistant to corrosion damage, either by use of coated copper wire or by other means. The free ends of tracer wire shall be coated or insulated.

Insulated tracer wire shall be accessible so a connection can be made to the pipe locator transmitter. Several methods to provide for locating wire accessibility include:

a. bringing the tracer wire up at a valve or curb box,

b. terminating tracer wire in a plastic line marker or test station, or

c. connecting service line tracer wire to main tracer wire.

Do not connect the tracer wire to or allow it to come in contact with in-service metallic main or service line pipe or fittings.

Anodes should not be installed on tracer wire since these may cause pipe locator signal interference. (See exception in Section 3.3 below). Additionally, it is not necessary to provide cathodic protection on buried Company-approved tracer wire.

After backfilling or installation by boring is complete, the tracer wire shall be checked for continuity by a qualified person using a pipeline locator to ensure the wire's traceability. If the complete installation cannot be traced, then the point where the signal is lost should be excavated to remedy the tracer wire's continuity. If exposing the wire at the point of discontinuity is not practical or it cannot be traced, accurate measurements of the pipe from permanent references shall be recorded. In addition, the installation of additional aboveground and belowground (electronic) markers, and the use of other methods for making the pipe locatable, should be considered. These additional measures should be performed at particular locations, such as changes in direction, service tee locations (if not otherwise recorded), and locations otherwise determined to be difficult to locate.

3.3 End of Main

Tracer wire shall be installed to the end of all plastic mains and a 3 lb. anode attached to it to provide for a stronger radio detection signal. The anode shall be attached to the tracer wire using an approved connection method. If the main is extended in the future the anode shall be removed.

3.4 Tracer Wire Stations

New installations of line markers (e.g., post style, flush mounted) that house tracer wire used to locate plastic pipeline (i.e., tracer wire station or TWS) shall be mapped in the Company's geographic information system (GIS).

Existing tracer wire stations (TWS) may be mapped in the Company's GIS by submitting a map revision in accordance with GS 2610.040 "Map Revision."

3.5 Electronic Markers

The installation of buried electronic markers shall be considered for all plastic pipeline installations. While tracer wire is intended to be the primary means to locate plastic pipe, electronic markers can provide a secondary means in the event the tracer wire has lost continuity, and can accurately indicate the location of certain pipeline features.

In addition to criteria for marker installation provided in Gas Standard GS 3010.050, "Installation of Pipe in a Ditch" electronic markers should be installed at:

a. fittings having directional changes of 45 degrees or greater;

b. branch connections, including in-line tees, tapping tees, and saddle tees; and

c. intervals along the pipeline near landmarks, such as utility poles, where electronic markers are not installed for other considerations, especially in areas where the pipeline location cannot easily be referenced from fixed objects.

The electronic markers shall be installed according to Gas Standard GS 3010.050.

4. TEMPORARY INSTALLATION ABOVE GROUND

Uncased plastic pipe may be temporarily installed above ground level under the following conditions:

1. The operator must be able to demonstrate that the cumulative aboveground exposure of the pipe does not exceed the manufacturer's recommended maximum period of exposure or 2 years, whichever is less.

2. The pipe either is located where damage by external forces is unlikely or is otherwise protected against such damage.

3. The pipe adequately resists exposure to ultraviolet light and high and low temperatures.

5. INSTALLATION ON BRIDGE CROSSINGS

When installing plastic pipe on bridges, it must be:

1. installed with protection from mechanical damage, such as installation in a metallic casing;

2. protected from ultraviolet radiation; and

3. not allowed to exceed the temperature limits for which the pipe design pressure was determined.

6. RECORDS

All applicable Company information for the installation of pipe shall be recorded in the work completion records for updating databases, maps, etc., and retained as required by the work completion process.

New installations of tracer wire stations (TWS) shall be indicated on the as-built drawing with swing-tie measurements in accordance with GS 2610.015 "Mapping Reference Dimensions for Pipeline Installations" and mapped in the Company's geographic information system (GIS).

For installations where the tracer wire cannot be used to locate the pipe, the additional recorded information (e.g., location measurements and belowground electronic marker locations) shall be submitted for inclusion in the Company databases, maps, etc.

MiSource

Gas Standard

Distribution Operations

Effective Date: 07/01/2012	**Transmission Lines and Distribution Mains** **Casing**	Standard Number: **GS 3010.070**
Supersedes: 03/01/2010		Page 1 of 9

Companies Affected:	☑ NIPSCO	☑ CGV ☑ CMD ☑ CKY ☑ COH ☐ CMA ☑ CPA

REFERENCE 49 CFR 192.323

1. GENERAL

This standard covers the use and installation of casing and carrier piping for transmission lines or distribution mains.

The use of casing pipe shall be limited to areas where it is determined necessary to protect or support the carrier pipe, or at locations where required by state or local ordinances or railroads.

Each casing used under a highway or railroad must comply with the following:

a. the casing must be designed to withstand the superimposed loads,

b. both ends of the casing shall be sealed and an approved casing filler used (see Section 5) when the carrier pipe is steel in metallic casing,

c. the vents (see Section 3) must be protected from the weather to prevent water from entering the casing, and

d. consideration should be given to the casing having a uniform slope from one end to the other.

Where plastic piping must be cased or bridged, suitable precautions should be taken to prevent crushing or shearing the piping.

The Company's Representative, whether employee or contractor:

a. shall inspect each project/job site to ensure that all work complies with Company procedures and is done in accordance with all governmental regulations; and

b. has the authority to order the removal or correction of any portion of construction, welds, fusions, mechanical joints, coatings, backfill, etc. that do not meet the Company's requirements.

2. CASING INSTALLATION

Casing is normally steel pipe, but can be plastic pipe, if approved by the permitting authority.

If more than one joint of steel pipe is used for casing, the pipe joints shall be welded by a Nisource qualified welder. Joints of plastic pipe casing shall be fused according to Company procedures by a qualified person.

When installing steel casing, below ground use bare steel with a minimum SMYS of 35,000 psi (e.g., Grade B). For above ground casings, atmospheric corrosion protection shall follow section 4 of GS 1450.010. Also for railroad crossings, follow the minimum wall thickness required for steel casing according to Table 1. Refer to Exhibit B for additional information.

Table 1 – Minimum Steel Wall Thickness for Railroad Crossings

Casing Size	Under 14”	14”–16”	18”	20”	24”	26”	28”–30”
Wall Thickness	0.188”	0.219”	0.250”	0.281”	0.344”	0.375”	0.405”

The casing may be installed by either open trench or a trenchless technology method (e.g., augering), according to the installation conditions and requirements. When vents are not installed according to Section 3, buried electronic markers should be located at each casing end, and shall be installed according to Gas Standard GS 3010.050, “Installation of Pipe in a Ditch.”

3. VENTS

Vents should only be installed when required by an outside authority or to permit the installation of casing filler. Where possible, installation of casing vents shall be made prior to insertion of carrier pipe. In any case, damage to carrier pipe or coating caused by installing vents on casing shall be repaired.

Preference should be given to locating vents over the main. Vents in locations subject to high water shall be extended above the high water level and shall be properly supported and protected.

When vents are installed on casing, the vent pipe shall be no smaller than two (2) inches in diameter. Once the casing is in place in the bore, cut the vent (filler pipe) holes near each casing end at a minimum distance of 18” from the end. The hole diameter should be slightly less than the vent (filler pipe) ID. The vent shall not touch or rest on the carrier pipe.

The vent shall be fully joined to the casing to ensure it is leak free. The vent at the highest end of the crossing should be attached to the top of the casing and the vent at the low end to the bottom of the casing to provide for complete filling when installing casing filler. Where filling is to be delayed, an end cap should be installed on each fill pipe. Vents should extend to a convenient location and shall terminate at least four (4) feet above ground surface with a down-turned elbow.

4. CARRIER PIPE

When the carrier pipe is coated steel, it should be electrically inspected for coating holidays prior to insertion by using an approved holiday detector set to the proper voltage level for the existing coating. All holidays shall be repaired with an approved coating. Refer to Gas Standard GS 1420.410, “Inspection of Steel Pipe Coating.”

The leading end of the carrier pipe (steel or plastic) shall be closed before insertion to prevent dirt from entering it. End caps may be used to accomplish this.

4.1 Casing Insulators

Prior to inserting coated steel pipe in steel casing, casing insulators (spacers) shall be attached to the carrier pipe to eliminate electrical contact between the casing and the carrier pipe. Two insulators shall be installed as close as possible to each casing end, while still allowing space for the end seals and not covering the vent holes. The insulators shall be installed tightly but not as to penetrate the pipe coating. The insulators should be oriented such that no bolts remain at the bottom (6 o'clock) position.

Insulators are recommended when installing plastic pipe in steel casing and are not necessary for a plastic casing.

The insulators should be installed at six (6) foot intervals, with a maximum recommended distance between insulators of 10 feet, as specified by Exhibits A and B. A strip of cold-applied tape is recommended to be wrapped around the carrier pipe beside the insulator to help protect the coating from insulator movement. The carrier pipe should be lifted with slings positioned so as not to interfere with the insulators.

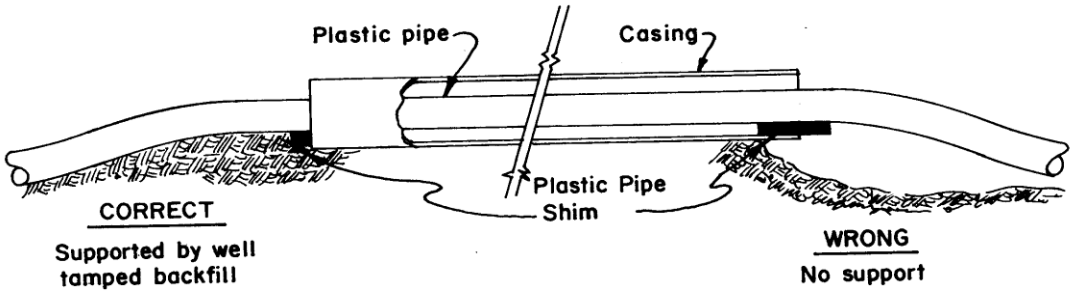
4.2 Insertion into Casing

The pipe/casing alignment should be observed prior to moving the pipe into the casing. Care should be taken to ensure there is no spacer movement or other cause for coating or spacer damage. The push/pull should continue in a smooth manner until the carrier pipe is in the proper position. Where plastic pipe is inserted in casing, the pipe shall be inserted in such a manner that will prevent cuts and abrasions.

After insertion, at least five feet of the leading end of the carrier pipe shall be visually inspected for damage. If any damage is found that would impair the serviceability, all of the carrier pipe shall be inspected. Any damage to the carrier pipe shall be corrected according to the applicable Gas Standard GS 3010.010, “Repair of Steel Pipe” or GS 3010.020, “Repair of Plastic Pipe.”

Plastic carrier pipe shall be continuously supported on solid ground where it enters and leaves the casing pipe. A plastic shim shall be placed under the plastic carrier pipe where it enters and leaves the casing, as illustrated in Figure 1.

Figure 1 – Plastic Carrier in Steel Casing



4.3 End Seals

Steel carrier pipe in steel casing shall have end seals installed.

There are two styles of end seals: plain rubber and reinforced plastic centering. The plain rubber is the normal end seal, while the plastic centering is used for larger OD pipe sizes. Corrosion personnel should be consulted to specify which style of seal to use.

Follow the manufacturer's installation instructions for end seal installation.

All water and debris should be removed from the casing prior to installing the end seals by blowing air through it.

Prior to backfilling, coat the end seal exposed metal plates and bolts with an approved underground coating.

Plastic carrier in steel casing shall not have end seals, but shall have a boot-style seal or polyurethane foam applied to both ends.

4.4 Corrosion Test Leads

When steel carrier pipe is used, a test station shall be installed in accordance with corrosion Gas Standard GS 1420.520, “Installation of Test Stations.” The test leads shall be thermite welded on the casing, if steel, and carrier pipe and the connections coated at this time. Refer to corrosion Gas Standard GS 1420.580, “Thermite Weld Process.” For steel casing, the pipe-to-casing electrical resistance (continuity) shall be checked to ensure the casing is electrically insulated from the carrier pipe before proceeding.

5. CASING FILLER

Steel casings with steel carrier piping shall be filled with an approved dielectric casing filler.

Casing fillers are petroleum compounds containing corrosion inhibitors. They are similar to heavy grease, but are gels and become more liquid when heat and pressure is applied, and return to the original gel when heat and pressure is removed.

5.1 Filler Types

There are two types of casing fillers: 1) hot type and 2) cold type.

1. Hot type fillers are recommended for all installations, where practical. They are available for delivery in an insulated, heated tanker truck, and therefore are easier to pump than cold type fillers. They require a variable flow pump.
2. Cold type fillers may be used where a small quantity is required. The material is supplied in 55-gallon drums and requires a mastic type pump. They should be used only in warm weather per manufacturer's specifications. They can be pumped directly from the drum with little or no heat applied.

5.2 Quantity of Filler

Table 3 should be used for estimating the quantity of casing filler needed. Use the process below to determine the approximate number of gallons of filler.

1. For the nominal casing size, find its capacity in gallons per foot.
2. Find the carrier pipe displacement for its nominal size.
3. Subtract the carriers displacement from the casing capacity. The result will be the amount of filler needed per foot of casing.
4. Multiply the filler per foot by the length of casing to determine the number of gallons of filler needed.

Table 3 – Estimating Casing Filler Quantity

Nominal Pipe Size [in.]	Casing Capacity [gallons/ft.]	Carrier Displacement [gallons/ft.]
4	0.65	0.83
6	1.50	1.79
8	2.60	3.03
10	4.13	4.71
12	5.93	6.63
14	7.16	8.00
16	9.49	10.44
18	12.14	13.22
20	15.12	16.32

EXAMPLE: 6" pipe in 50 ft. of 10" casing

1. 10” casing capacity is 4.13 gals/ft
2. 6” pipe displacement is 1.79 gals/ft
3. Filler required is 4.13 - 1.79 = 2.34 gals/ft of casing
4. Total filler required is: 2.34 gals/ft x 50 ft = 117 gallons

5.3 Installation

Install the filler according to the following steps.

a. Blow dry the inside of the casing.

b. Test to ensure electrical isolation has been achieved between the casing and carrier pipe.

c. Air test annular space at 5 psig for a sufficient period to ensure it has been effectively sealed.

d. Inject casing filler into casing through the vent pipe at the lowest end (attached to the bottom of the casing) or appropriate connection to the casing per manufacturer's recommendations. The method of insertion depends upon the type of filler being used.

e. Filler must continue to be injected until it begins to come out of the other (high end) vent.

6. RECORDS

All Company records shall be completed in accordance with the construction project, including Form GS 3010.070-1 (see Exhibit C) for recording casings filled.

Corrosion-related records are to be completed and maintained according to the applicable corrosion Gas Standards.

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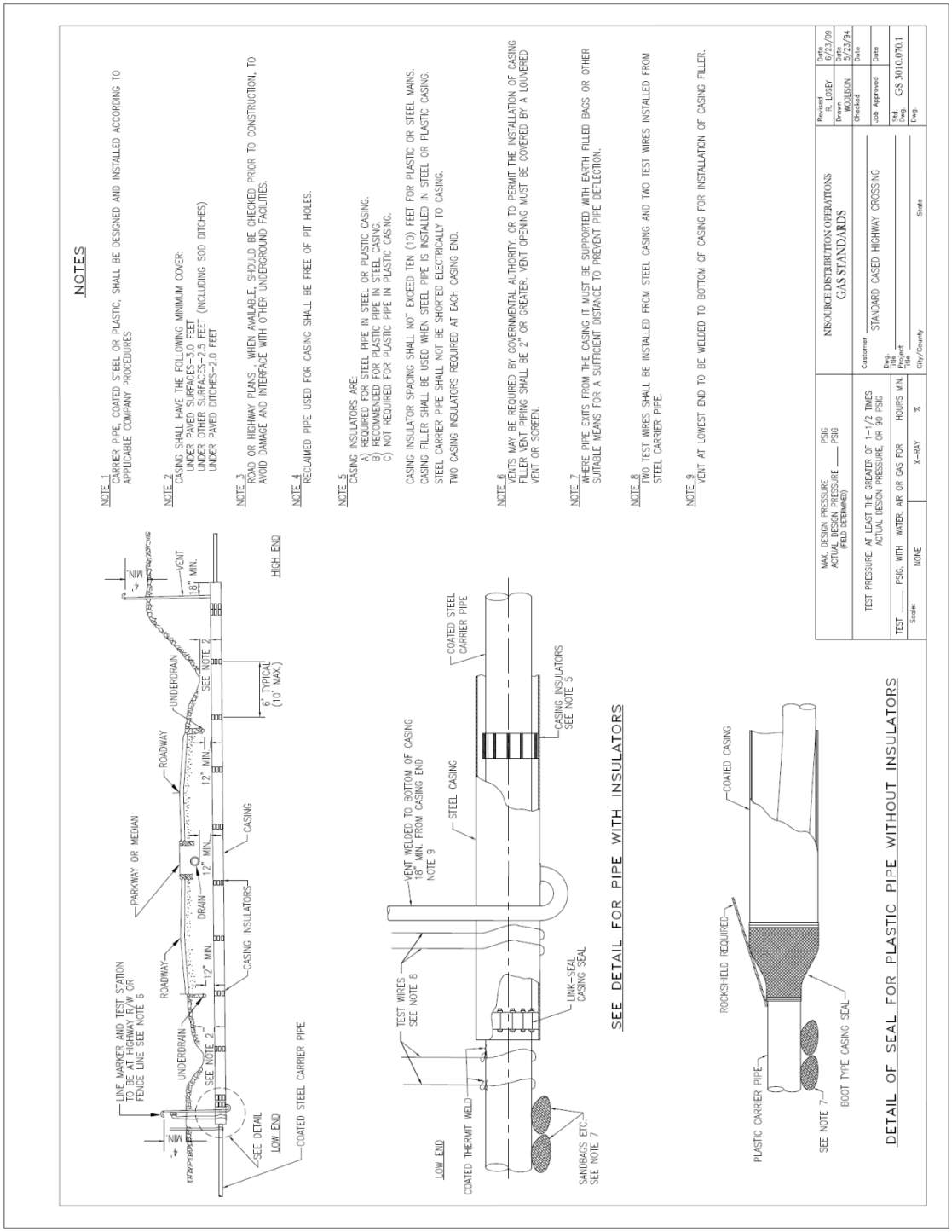
Gas Standard

Distribution Operations

Effective Date: 07/01/2012	**Transmission Lines and Distribution Mains** **Casing**	Standard Number: **GS 3010.070**
Supersedes: 03/01/2010		Page 7 of 9

Exhibit A

Standard Cased Highway Crossing



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Gas Standard

Distribution Operations

Effective Date: 07/01/2012	**Transmission Lines and Distribution Mains** **Casing**	Standard Number: **GS 3010.070**
Supersedes: 03/01/2010		Page 8 of 9

Exhibit B

Cased Railroad Crossing

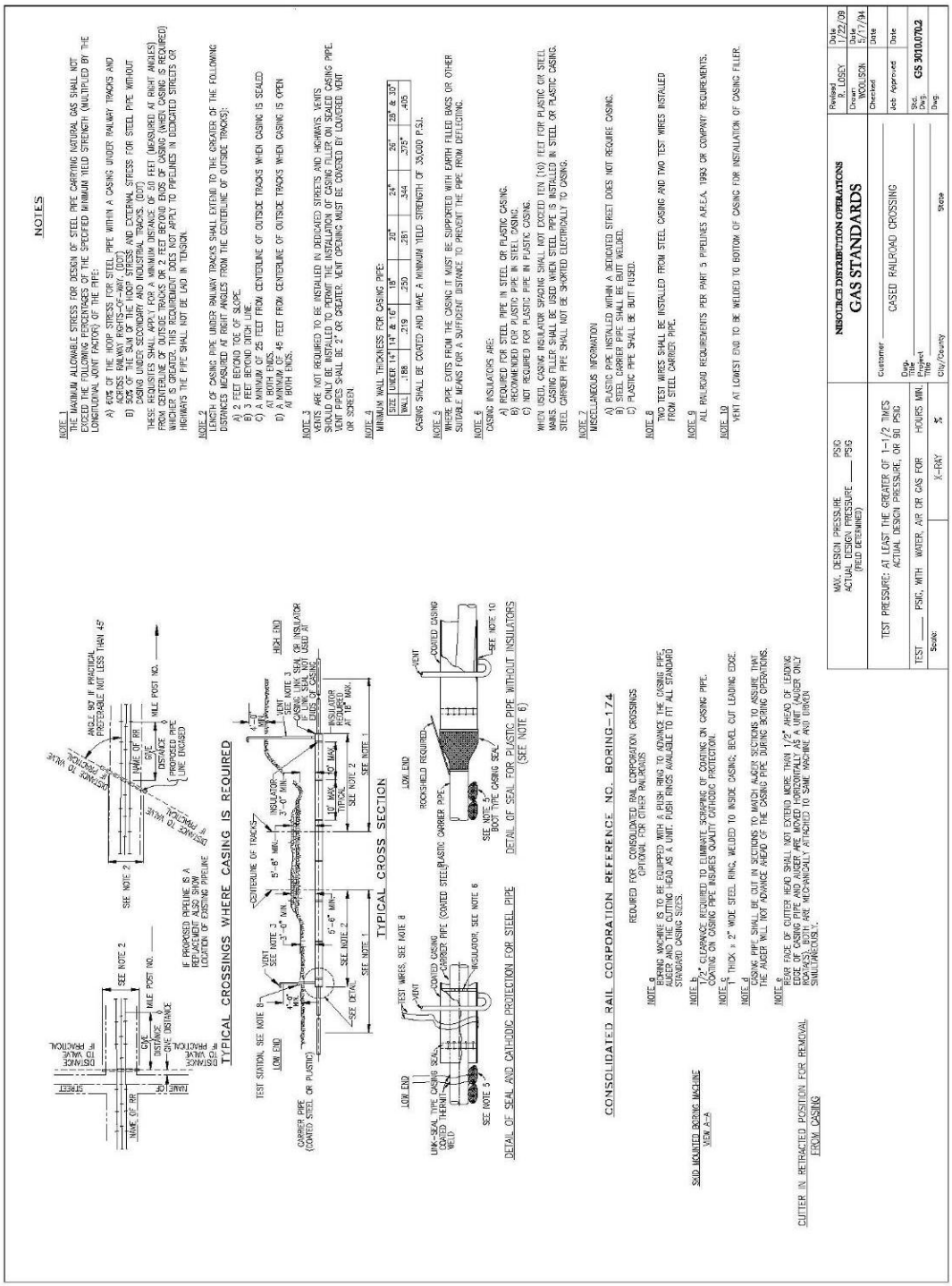

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Exhibit C

Report of Casings Filled

NiSource Distribution Operations

REPORT OF CASINGS FILLED WITH A PETROLEUM-BASED COMPOUND

Location

Street _____ and _____

City _____ State _____

County _____ Twp _____

Railroad _____ Other _____

Map no. _____ Line / Section # _____

☐ Distribution ☐ Transmission

Reasons for Filling

☐ New Installation

☐ Maintenance
- ☐ Shorted
- ☐ Abandoned
- ☐ Other (describe) _____

Filled by _____ (Company / Contractor name)

Filled with _____ (Product name)

Carrier size _____ Casing size _____

Gallons _____

Comments (additional information) _____

_____

_____

* Sketch Location - Use back of sheet if necessary *

Completed by _____ Date _____

Form GS 3010.070-1

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Distribution Operations

Gas Standard

Effective Date: 03/27/2013	**Transmission Lines and Distribution Mains** **Underground Clearance**	Standard Number: **GS 3010.080**
Supersedes: 10/10/2012		Page 1 of 2

Companies Affected:

☑ NIPSCO	☐ CGV	☑ CMD
	☑ CKY	☐ COH
	☐ CMA	☑ CPA

REFERENCE 49 CFR 192.325

1. GENERAL

This standard provides the requirements and guidance for clearance between underground Company gas pipelines and other structures (facilities). The intent is to protect the Company pipelines from other operators performing work on their facilities and allow clearance the Company to maintain the pipelines.

2. CLEARANCE

The clearance specified in this section pertains to other existing underground structures encountered, and any known planned installations of other underground structures.

NOTE: Besides the requirements of this standard, specific other state code, municipal permitting, or other requirements regarding minimum clearance may apply, and must be addressed appropriately.

2.1 Transmission Lines

Each transmission line must be installed with at least 12 inches of clearance (18" of radial separation for Columbia Gas of Pennsylvania per state regulations) from any other underground structure not associated with the transmission line. If this clearance cannot be attained, the transmission line must be protected from damage that might result from its proximity to the other structure.

Adequate measures to prevent contact between the pipeline and an underground structure include, but are not limited to:

a. encasement of the pipeline with concrete, polyethylene, or vulcanized elastomer,

b. installing the pipeline in steel casing, or

c. the installation of sand/cement bags, concrete pads, or open-cell polyurethane pads in the space between the pipeline and the underground structure.

2.2 Distribution Mains

Each main must be installed with enough clearance from any other underground structure to allow proper maintenance and to protect against damage that might result from proximity to other structures. It is recommended to maintain at least 12 inches of clearance.

Sufficient clearance to maintain mains is needed to:

a. permit installation and operation of maintenance and emergency control devices, such as leak clamps, pressure control fittings and pinching equipment; and

b. permit installation of service laterals to both the mains and to other underground structures as might be required.

Plastic mains have the additional requirement to be installed with sufficient clearance, and/or must be insulated, from any source of heat to prevent the heat from impairing the serviceability of the pipe. Particular heat sources of concern are steam or electric power lines. Consult Field Engineering to determine sufficient clearance or adequate insulation. Where heat sources are present and sufficient clearance cannot be attained or insulation cannot be installed, consideration should be given to installing steel pipe instead.

Measures to prevent contact with other underground structures include those listed for transmission lines in Section 2.1 above.

3. RECORDS

The location of pipelines shall be accurately marked on work completion sketches, and the presence of other structures, with the clearance distance to them, should be indicated.

The records are part of the pipeline installation information, and are filed / retained with them accordingly.

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Distribution Operations

Gas Standard

Effective Date: 01/01/2013	**Transmission Lines and Distribution Mains** **Cover**	Standard Number: **GS 3010.090**
10/10/2012		Page 1 of 2

Companies Affected:

☐ NIPSCO	☐ CGV	☑ CMD
	☑ CKY	☑ COH
	☐ CMA	☐ CPA

REFERENCE 49 CFR 192.327

1. GENERAL

The cover requirements of this standard are minimums. Additional cover should be provided where the potential for damage by outside forces exists. Consideration should be given to the following conditions.

a. Agricultural land where deep plowing equipment or sub-pan breakers are used.

b. Agricultural land where the grade may be changed to permit irrigation or drainage.

c. Drainage ditch crossings. Consideration may also be given to alternates such as casing or a protective concrete or steel slab.

d. Other utility crossings. The new gas facilities should be installed under the existing facilities unless adequate cover can be provided, or casing, bridging or other protection is used.

e. Locations where erosion due to wind, water, or vehicular activity may affect the grade. Riprap, paving, or some other means of protection may be used in lieu of additional cover.

f. Street locations where future street work is anticipated.

There may also be greater minimum cover requirements as per state code, zoning / permitting requirements of some counties or municipalities, and soil districts' requirements that supersede the minimums in this standard.

Where an underground structure prevents the installation of a pipeline with the minimum cover, the pipeline may be installed with less cover if it is provided with additional protection to withstand anticipated external loads.

Except where an underground structure prevents the installation of a pipeline with the minimum cover, all pipe installed in a navigable river, stream, or harbor must be installed with a minimum cover of 48 inches in soil or 24 inches in consolidated rock between the top of the pipe and the underwater natural bottom (as determined by recognized and generally accepted practices).

2. TRANSMISSION LINES

Install buried transmission lines in upland construction (non-waterways and not off shore) with a minimum cover as in the following Table 1.

Table 1 – Minimum Cover for Transmission Lines – Upland Construction

	Minimum Cover [inches]	
Location	Normal soil	Consolidated rock
Class 1 locations	30	18
Class 2, 3, and 4 locations	36	24
Drainage ditches of public roads and railroad crossings	36	24

3. DISTRIBUTION MAINS

Mains shall be installed with a cover (depth) according to Table 2. Measurement for cover is made from the top of the pipe to the finished grade.

Table 2 – Cover for Distribution Mains

	Minimum Cover [inches]	
Pipe Size [inches]	Normal Cover	Minimum Cover
Over 20	36	28
12 thru 20	36	24
10 and under	30	24

Additional cover in unpaved areas should be considered where heavy traffic conditions, such as construction/coal trucks or tractor-trailer rigs, would cause greater than normal external loading conditions.

Where consolidated rock is encountered and 24 inches of cover is not economically feasible, Field Engineering shall be contacted for possible alternatives.

4. RECORDS

The cover of the pipeline shall be recorded and retained according to the pipe installation completion work.

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Gas Standard

Distribution Operations

Effective Date: 10/13/2014	**Transmission Lines and Distribution Mains** **Trenchless Technology**	Standard Number: **GS 3010.100**
Supersedes: 04/01/2011		Page 1 of 3

Companies Affected:

☑ NIPSCO Effective: 06/01/2012	☐ CGV	☑ CMD
	☑ CKY	☑ COH
	☑ CMA	☑ CPA

REFERENCE N/A

1. GENERAL

Trenchless technology is any pipe installation method that precludes the need to make an open trench excavation. It may be necessary or preferred to use trenchless technology to install pipe under a highway, street, or other object, or to minimize surface restoration. The intent is to install a gas pipeline or casing for a gas pipeline.

This standard applies to the use of certain types of trenchless technology, to construct transmission lines, distribution mains and/or service lines, such as:

a. directional drilling (GS 3010.102),
b. boring / piercing (GS 3010.106),
c. augering: with casing (GS 3010.104) and without casing (GS 3010.106),
d. jacking (GS 3010.106),
e. driving (GS 3010.106), or
f. other mechanical means (GS 3010.106).

Refer to the related Gas Standards for specifics of each trenchless technology method.

The work includes the excavation and backfill of all necessary approach, completion, and spotting pits, which are to be done in compliance with related excavation and restoration Gas Standards. When a casing is installed, refer also to Gas Standard GS 3010.070 “Casing”.

For damage prevention guidelines associated with the use of trenchless technology, refer to Gas Standard GS 1100.050 "Damage Prevention - Using Trenchless Technology.”

The Company’s Representative, whether employee or contractor:

a. shall inspect each project/job site to ensure that all work complies with Company procedures and is done in accordance with all governmental regulations; and

b. has the authority to order the removal or correction of any portion of construction, welds, fusions, mechanical joints, coatings, backfill, etc. that do not meet the Company's requirements.

2. CONSTRUCTION REQUIREMENTS

The bore hole made by using a trenchless technology will effectively produce a hole of the specified diameter through which the gas pipeline or casing may be inserted without disturbing the ground surface or diminishing the structural integrity of any paved surface under which it passes.

All pipe installed by trenchless technology, either for steel or plastic carrier or casing pipe, must be joined by butt-welding or butt-fusion, as applicable, in accordance with standard procedures by a qualified person. All plastic pipe joints to be passed into the bore hole shall be made by butt-fusion.

All piping must be installed into the bored hole in a manner to minimize any damage to the pipe wall or coating. If significant damage to the pipe or coating is likely, the bore hole shall be enlarged or the pipe encased. After insertion of the carrier pipe into the bore hole, inspect the leading end for damage. Repair or replace any damage found.

For plastic carrier pipe, tracer wire shall be installed in the bored hole along with the pipe. Warning tape need not be installed if not practical. If the plastic pipe is installed in a steel casing, the tracer wire may be attached to the steel casing pipe by suitable means. Again, marking tape need not be installed if not practical.

When installing a gas pipe under a railroad or state highway, respective authorities may require adherence to their guidelines and principles. Their requirements must be followed unless they conflict with application Federal, state, and/or local rules. If so, the appropriate authorities must reach a consensus before the pipe is installed.

3. PROVIDING FOR LOCATING

Upon completion of the new or replacement pipeline installation, the entire pipeline shall be located with appropriate markings and stakes/flags by the Company or Company's contracted personnel according to Gas Standard GS 1100.010 "Locating Gas Facilities".

3.1 Criteria for Placing Electronic Markers

The installation of electronic markers shall be considered in addition to other required means to locate pipelines and facilities. The electronic markers should be installed at:

a. the limits of the bores or physical features bored under, such as rivers, highways, and railroads;

b. segments of the pipeline deeper than 15 feet; and

c. intervals along the pipeline near landmarks, such as utility poles, where electronic markers are not installed for other considerations, especially in areas where the pipeline location cannot easily be referenced from fixed objects.

3.2 Electronic Marker Installation

The electronic markers may be installed after the pipeline installation by isolated excavation holes.

Electronic markers shall be installed per the manufacturer's instructions.

Electronic markers also shall be installed per the following conditions.

a. Markers should not be placed within six (6) inches of known metallic structures such as metallic valve boxes or metallic conduit.

b. Where markers are employed to locate valves, the markers shall be installed one (1) foot north or west of the valve, over the main line.

c. Markers should be installed above the pipeline or features at the top of the bedding material, as shown in Figure 1.

d. Markers should not be installed at a depth greater than 36 inches.

e. Care must be taken when backfilling to prevent changing the location of the marker.

4. DEPTH OF BORES

Bore depths must comply with the minimum cover requirements of Gas Standard GS 3010.090 "Cover." It is recommended that bores be made with additional depth to ensure the minimum cover is maintained throughout the entire length of the bore. For distribution mains and transmission lines, bores should be at least 36 inches deep. For service lines, bores should be 24 inches deep.

Consideration should be given to not making bores excessively deep. While a deeper bore may allow for missing other underground facilities or making a much larger hole, the excessive depth could cause the Company to incur greater costs for excavating the piping to attach laterals or to perform maintenance.

5. RECORDS

Follow all pipe installation recording requirements according to Gas Standard GS 3010.050 "Installation of Pipe in a Ditch" and GS 3010.060 "Installation of Plastic Pipe."