

EXHIBIT S

SITE

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TSS-1 Site Data

Trimble County (TC) Generating Station is located approximately five miles west of Bedford, Kentucky. TC is the site of two (2) pulverized coal-fired electric generating units with a total nameplate capacity of 1,357 MW gross, and six (6) simple cycle gas turbines with a total capacity of 900 MW. The coal-fired Unit 1 has a gross capacity of 547 MW, and the coal-fired Unit 2 has a gross capacity of 810 MW, while each gas turbine is rated 150 MW.

Unit 1 is equipped with low NO_x burners (LNBS), over fired air system (OFA), and selective catalytic reduction (SCR) for NO_x control, a cold-side dry electrostatic precipitator (ESP) for particulate matter (PM) control, hydrated lime injection for sulfur trioxide (SO₃) control, and a sulfur dioxide (SO₂) reduction system (SDRS) for SO₂ and HCl control. A major Unit 1 capital construction project to add a pulse-jet fabric filter (PJFF) with powder activated carbon (PAC) injection for Hg control and the collection of fly ash is ongoing; tie-in is scheduled during November of 2015.

Unit 2 is equipped with LNBS, OFA, and SCR for NO_x control, boiler combustion optimization and Neural Networks for carbon monoxide (CO) control, a cold-side dry ESP for PM control, a PJFF with PAC injection for Hg and dioxin/furan control and with hydrated lime injection for SO₃ control, a wet flue gas desulfurization (WFGD) for SO₂ and HCl control, and a wet ESP for additional H₂SO₄ (SO₃) control.

Fly ash collected in each unit's ESP and PJFF is either collected as a dry product or sluiced to the bottom ash pond (BAP) for storage. Economizer and air heater ash collected in each unit's ash hoppers is currently sluiced to the BAP for storage.

Bottom ash from Unit 1 is sluiced to the BAP for either storage or collection for future landfill leachate collection layer. Unit 1 pyrites are locally dewatered in a bunker north of Unit 2 and trucked to the BAP for storage. Unit 2 bottom ash and pyrites are locally dewatered in a bunker North of Unit 2 and are trucked to the Northeast corner of the coal pile for future landfill leachate collection layer.

Absorber bleed slurry from each unit's WFGD is sent either to the existing gypsum storage pond (GSP) for storage, or to the existing Syn-Mat facility to dewater and market the gypsum product, or to the existing BAP. The GSP has a permitted outfall while the BAP is zero liquid discharge.

The site is accessed via road or by barge. The barge equipment unloading dock is serviced by a 750-ton gantry crane, and the dock is large enough to accommodate mobile crane equipment for loading and off-loading equipment and materials. The site does not have rail access.

Project Summary:

Project Name:	Trimble County CCR Treatment
Owner:	Louisville Gas & Electric Company and Kentucky Utilities Company (LG&E/KU)
Operator:	Louisville Gas & Electric (LG&E)
Project Site Address:	487 Corn Creek Rd., Bedford, KY 40006
On-Site Work:	Start Construction – 2015
In Service Date:	2017

Existing Facilities Data:

Existing On Site Generation Units:	Unit 1 - 547 gross MW (in-service date 1990) Unit 2 - 810 gross MW (in-service date 2010)
Existing Air Quality Control Equipment:	Unit 1 - LNBS, OFA, SCR, cold-side dry ESP, DSI, PAC injection, PJFF, Wet FGD aka SDRS Unit 2 - LNBS, OFA, SCR, boiler combustion optimization and Neural Networks, cold-side dry ESP, DSI, PAC injection, PJFF, wet FGD, wet ESP
Site Location:	Site is located approximately five miles west of Bedford, Kentucky.
Site Access:	By road: Access from KY-1838, KY-754, US-42, US-421, and I-71 By river: Site is located at the 572 mile marker on south bank of the Ohio River and has barge unloading facilities, including an equipment unloading dock serviced by a 750-ton gantry crane. No access via rail system

Site Elevation: 475 ft. MSL

Fuel: Fuel Oil for Startup
 TC1: High Sulfur Western Kentucky Bituminous Coal from Illinois Basin, Eastern Kentucky, and miscellaneous others
 TC2: PRB at a 0-50% blend with Eastern Bituminous

Other Additions: PAC (Captured in the PJFF Fly Ash)
 Hydrated Lime (Captured in AH, DESP, and PJFF Fly Ash)
 Re-emission additive (in wet FGD) are used for SO3 and Hg capture

Bulk Material Handling: Coal and limestone are delivered to the station solely by barge. Separate barge loading facilities are available for fly ash and gypsum.

Water Source: Potable Water: Trimble County Water District
 Service Water: Ohio River Water

DCS System: Emerson Ovation

Additional design criteria:

Plant design is based on the criteria listed in the following table.

Table TSS - 1.1 Performance Design Basis	
Parameter	Basis Value
Ambient Temperature	77 °F Dry Bulb
Ambient Pressure	29.49 in Hg
Ambient Humidity	60.0 % Relative Humidity
Fuel Analysis	Refer to TSS-2 – Fuel Specification

This table summarizes the meteorological data applicable to plant design.

Table TSS - 1.2 Meteorological (Ambient and Extreme) Data		
Design Parameter	Design Value	Units
Rainfall – 24 Hour, 10 Year Event (Design rainfall parameter may vary depending on local codes or agencies.)	4.55(A)	Inches
Rainfall – 24 Hour, 25 Year Event (Design rainfall parameter may vary depending on local codes or agencies.)	5.43(A)	Inches
Rainfall – Average Annual Total	44.54(B)	Inches
Design Rain Rate (100 year recurrence)	3.2(C)	inches per hour
Evaporation Rate – Annual Average NWS Class A Evap Pan	51.13(D)	Inches
Design Wind Speed, V_{ult}	120*(C, I)	Mph
Risk Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake, and Ice Loads (Table 1.5-1)	III(E)	
Wind Design Exposure (Chapter 26)	Category C(E)	N/A
Topographic Factor, K_{zt}	1.0	
Average Wind Speed	8.3(F)	Mph
Prevailing Wind Direction (from)	South-southwest (G)	

Table TSS - 1.2 Meteorological (Ambient and Extreme) Data		
Design Parameter	Design Value	Units
Frost Depth (50 Year Recurrence)	32(C)	Inches
Snow Load – Ground, pg	20(I)	lb./ft2
Snow Importance Factor, Is	1.10(E)	
Open Structure Icing Design Conditions	0.75 inches ice thickness with 30 mph concurrent wind speed(I)	
Freeze Protection Design Conditions	-23.1°F (H) DB with 8.3 (F) mph coincident wind	
Importance Factor (Ice Loads – Ice Thickness), Ii	1.25	
Importance Factor (Ice Loads – Concurrent Wind), Iw	1.0	
Annual Barometric Pressure, adjusted to site elevation	29.49(C)	in. Hg
Design Ambient Temp (Extreme High)	113 DB(H)	°F
Design Ambient Temp (Extreme Low)	-23.1 DB(H)	°F
Design Annual Average Ambient Temp	56.9(B)	°F
Winter Design (Dec-Feb) Ave Temp	36.1(B)	°F

Table TSS - 1.2 Meteorological (Ambient and Extreme) Data		
Design Parameter	Design Value	Units
Summer Design (Jun-Aug) Ave Temp	76.5(B)	°F
Space Conditioning Ambient Design Temps (ASHRAE Fundamentals, 1.0%)	91.2 DB(H)	°F
	75.3 MCWB(H)	°F
Space Conditioning Ambient Design Temps (ASHRAE Fundamentals, 2.0%)	89.0 DB(H)	°F
	74.3 MCWB(H)	°F
Space Conditioning Ambient Design Temps (ASHRAE Fundamentals, 99.0%)	14.5 DB(H)	°F
	13.0 MCWB(C)	°F

Table TSS - 1.2 Meteorological (Ambient and Extreme) Data		
Design Parameter	Design Value	Units
<p>Notes:</p> <p>Design conditions based on ASHRAE 2009 data for: Louisville, KY</p> <p>Approximate Location (Google Earth): Latitude: 38.05N Longitude: 85.91W Elevation: 465 ft. MSL</p> <p>*3-second gust at 33 ft. above ground</p> <p>References:</p> <p>(A)National Weather Service- Hydrometeorological Design Studies Center.</p> <p>(B)National Climatic Data Center (NCDC) Climate 20-Climate Normals; Louisville, KY.</p> <p>(C)Engineering Weather CD, "Summary for Louisville, KY 1973-1996," Engineering Weather Data, 2000 Interactive Edition, 2001, Version 1.0, [CD].</p> <p>(D)Technical Memorandum No. 34 from NWS, 1982.</p> <p>(E)ASCE 7-10.</p> <p>(F)NCDC United States Average Wind Speeds for US cities; Louisville, KY. Based upon 55 years of data, through 2002.</p> <p>(G)Wind roses from Integrated Surface Hourly Data (ISH) 1995-2008 data for Louisville, KY.</p> <p>(H)National Climatic Data Center (NCDC), "2009 ASHRAE Handbook Annual Summary with Comparative Data for Louisville, KY."</p> <p>(I)Kentucky Building Code,</p>		

This table summarizes the building code and site conditions applicable to plant design. Table references are to ASCE 7 as referenced by the Kentucky Building Code General Design Data:

Table TSS - 1.3 Kentucky Building Code General Design Data	
Building Code	2013 Kentucky Building Code
Risk Category for Flood, Wind, Snow, Earthquake, and Ice	III
Site Elevation (Mean Sea Level), ft.	475 ft. above MSL
Wind Design Data:	
Basic Wind Speed, V_{ult} , Nominal 3 second gust wind speed at 33 ft. above ground for Exposure C category, mph	120
Exposure Category	C
Topographic Factor, K_{zt}	1.0
Snow Design Data:	
Ground Snow Load, P_g , lb./ft ²	20
Importance Factor (Snow Loads), I_s	1.10
Ice Design Data:	
Nominal Ice Thickness, t , Due to freezing rain at a height of 33 ft. (10 m), inches	0.75
Concurrent Wind Speed, V_c , mph	30

Importance Factor (Ice Loads – Ice Thickness), I_i	1.25
Importance Factor (Ice Loads – Concurrent Wind), I_w	1.0
Seismic Design Data:	
Short Period Mapped Spectral Acceleration, S_s	0.177
One Second Period Mapped Spectral Acceleration, S_1	0.096
Site Class	D
Importance Factor (Seismic Loads), I_e	1.25

TSS-2 Coal Analysis

The Owner will use Eastern bituminous and Western sub-bituminous coals.

The following table depicts typical fuel qualities and the range of properties of coals used in the Unit 1. Equipment shall be designed for entire range of fuels.

Table TSS - 2.1 Unit 1 Solid Fuel Characteristics		
Basis of Analysis	Typical Fuel ¹ (as-received)	Range ² (as-received)
Higher Heating Value (Btu/lb)	11,000	10,000 -12,800
Moisture (percent)	14.0	5.0 – 20.0
Ash (percent)	12.0	6.0 – 20.0
Sulfur (lbs SO ₂ /mmBtu)	6.0	3.0 - 6.9

Note:

1. Typical values defined as monthly weighted average.
2. Range values defined as daily weighted average.

The following table depicts typical performance fuel specification and the range of properties of coals used in the Unit 2. Equipment shall be designed for entire range of fuels.

Table TSS - 2.2 Unit 2 Solid Fuel Characteristics		
Basis of Analysis	Typical Fuel ¹ 70/30 Blend (as-received)	Range ² (as-received)
Higher Heating Value (Btu/lb)	10,340	9,000 -12,800
Moisture (percent)	18.2	10.0 – 25.0

Table TSS - 2.2 Unit 2 Solid Fuel Characteristics		
Basis of Analysis	Typical Fuel ¹ 70/30 Blend (as-received)	Range ² (as-received)
Ash (percent)	10.5	5.0 – 20.0
Sulfur (lbs SO ₂ /mmBtu)	4.7	3.0 - 6.0

Note:

1. Typical values defined as monthly weighted average.
2. Range values defined as daily weighted average.

For Unit 2, the plant will normally operate using a typical blend of 70% bituminous and 30% of Western sub-bituminous, but shall be capable of operating using 100% bituminous high sulfur fuel.

TSS-3 Unit Coal Combustion Residuals Maximum Production Rates

Design CCR maximum production rates are based on a 100% capacity factor, worst case coal, worst case ash content, maximum sulfur dioxide removal, and worst case limestone. Actual unit CCR production rates will vary based on actual coal burned, actual unit capacity factor, etc.

Table TSS - 3.1 – Maximum CCR Production Rates

CCR Stream		Unit 1	Unit 2	Both	
Bottom Ash	Bottom Ash Produced (Dry)	tons/hr.	9*	11*	21*
	Est. Pyrites Produced (Dry)	tons/hr.	0.3*	0.3*	0.6*
Fly Ash	Fly Ash Collected (Dry)	tons/hr.	33	43	76
	Fly Ash, Lime & PAC Collected (Dry)	tons/hr.	36	48	84**
Gypsum	Gypsum Produced (Dry)	tons/hr.	53	60	113
	Gypsum Product [Gypsum + Inerts + Unreacted Limestone] (Dry)	tons/hr.	62	71	133

Note: *

1. Unit 2 bottom ash and pyrites are collected together in an existing local drag chain conveyor and bunker.
2. Unit1 pyrites are collected in a bunker adjacent to the Unit 2 bottom ash/pyrites bunker.
3. The Unit 1 bottom ash and pyrites and Unit 2 bottom ash and pyrites will be moved by truck from the bunkers to the CCRT apron belt feeder.
4. These production rates are included for sizing the equipment associated with the pipe conveyor, belt conveyor BC-10, and the apron belt feeder.

Note: **

1. Concentrations of PAC and lime contained within fly ash will vary with operation from zero to maximum rates.
2. Equipment design shall be capable of handling the full range of concentrations of PAC and lime within the fly ash.

Table TSS -3.2 – Existing Equipment Injection Rate and Location

TC1 DSI Injection Location	SCR Outlet aka Air Preheater Inlet or ESP Inlet (not both)		ESP Outlet
Rated Capacity	1,000 – 4,000 lb./hr.		1,000 – 4,000 lb./hr.
Current Injection Rate	2,500 – 3,000 lb./hr.	0	500 – 1,000 lb./hr.
Future Injection Rate with PJFF (Nov 2015)	2,000 lb./hr.	0	2,000 lb./hr.
TC1 PAC Injection Location	PJFF Inlet		
Rated Capacity	626 lb./hr.		
Current Injection Rate	0		
Future Injection Rate with PJFF (Nov 2015)	399 lb./hr.		
TC2 DSI Injection Location	Pre AH	Post AH	
Rated Capacity	600 – 6,000 lb./hr.	600 – 6,000 lb./hr.	
Current Injection Rate	3,000 lb./hr.	2,000 lb./hr.	
TC2 PAC Location	PJFF Inlet		
Rated Capacity	800 lb./hr.		
Current Injection Rate	0		
Future Injection Rate (as needed)	600 lb./hr.		

TSS-4 Bulk Material Densities

Table TSS - 4 Bulk Material Densities		
CCR Material	Unit Weight (Bulk Material Density)	
	Volume Design, pcf	Structural Design, pcf
ESP Fly Ash, PJFF Fly Ash, Economizer Fly Ash, Air Heater Fly Ash	65-75	130
Bottom Ash, Pyrites	50	120
Gypsum Product	60	100

Notes:

1. Density used for structural design shall be a minimum of the values listed above.
2. Volume design density identified above shall be used for calculating required storage.
3. The volume design density shall also be utilized for fly ash blower sizing.
4. pcf = pounds per cubic foot
5. Bottom ash, pyrites and gypsum systems shall be designed to convey materials at guaranteed performance rates at the entire range of bulk material densities listed in Table TSS – 4.

TSS-5 CCR Material Characteristics

Contractor shall be fully responsible for selecting sampling locations and performing tests on all CCR solid and liquid waste streams as needed to appropriately design equipment and systems and to complete all Work. The following analysis is provided only as minimum design values for the gypsum dewatering and transport systems.

Table TSS - 5 Gypsum Bleed Slurry Quality Analysis		
	Average	Minimum Design Operating Range
Unit 1 WFGD (SDRS) Bleed		
pH:	5.75	4.5 – 9.0
Chlorides, mg/L:	5,000 – 8,000	700 - 15,000
Solids Content, %:	15.0 – 20.0%	10.0 – 23.0%
Unit 2 WFGD Bleed		
pH:	5.75	4.5 – 9.0
Chlorides, mg/L:	3,000 – 10,000	600 - 15,000
Solids Content, %:	15.0 – 20.0%	10.0– 23.0%

TSS-6 Design Ambient Conditions

Area Specific Design: The general design ambient air conditions shall be used unless area specific or equipment specific conditions are indicated in the contract documents:

Table TSS - 6.1				
Area	Temperature, °F		Relative Humidity, %	
	Minimum	Maximum	Minimum	Maximum
General Outdoor Area, Trimble County	-24.6° F	113° F	0%	100%
Nominal outdoor minimum ambient design temperature for determining commodity material properties (pipe, valves, etc.) will be -20° F. Outdoor minimum ambient design conditions for determining freeze protection for piping and accessories shall be based on the all-time recorded ambient low temperature of -18° F.				

TSS-7 Paint Colors

Table TSS - 7 Paint Colors						
	Base Piping Color	Porter Paint # or Sherwin Williams	Legend	Safety Rating	Hazard	Label / Letter Colors
Steam Systems:						
Main Steam	Silver / Aluminum	N/A	Main Steam	Hazardous	Temp / Press	Yellow / Black
Hot Reheat Steam	Silver / Aluminum	N/A	Hot Reheat Steam	Hazardous	Temp / Press	Yellow / Black
Cold Reheat Steam	Silver / Aluminum	N/A	Cold Reheat Steam	Hazardous	Temp / Press	Yellow / Black
Extraction Steam	Silver / Aluminum	N/A	Extraction Steam	Hazardous	Temp / Press	Yellow / Black
Auxiliary Steam	Silver / Aluminum	N/A.	Auxiliary Steam	Hazardous	Temp / Press	Yellow / Black
Stack Plume Reheat	Silver / Aluminum	N/A.	Stack Plume Reheat	Hazardous	Temp / Press	Yellow / Black
Steam Vents	Silver / Aluminum	N/A	Steam Vents	Hazardous	Temp / Press	Yellow / Black
Plant Water Systems:						
Potable / City Water	Dark Blue	Safety Blue	Potable / City Water	Low Hazard		Green / White
Condensate	Light Blue	5182P Dawn Blue	Condensate	Hazardous	Temp / Press	Yellow / Black
Boiler Feedwater	Light Blue	5182P Dawn Blue	Feedwater	Hazardous	Temp / Press	Yellow / Black
Boiler Makeup Water	Light Blue	5182P Dawn Blue	Boiler Makeup Water	Low Hazard		Green / White
Demineralized Water	Light Blue	5182P Dawn Blue	Demineralized Water	Low Hazard		Green / White
Boiler Blowdown Water	Light Blue	5182P Dawn Blue	Boiler Blowdown	Hazardous	Temp / Press	Yellow / Black
Closed Cooling Water	Light Blue	5182P Dawn Blue	Closed Cooling Water	Low Hazard		Green / White

Table TSS - 7 Paint Colors						
	Base Piping Color	Porter Paint # or Sherwin Williams	Legend	Safety Rating	Hazard	Label / Letter Colors
Well Water	Dark Green	Safety Green	Well Water	Low Hazard		Green / White
River Water	Dark Green	Safety Green	River Water	Low Hazard		Green / White
Service Water	Dark Green	Safety Green	Service Water	Low Hazard		Green / White
Circulating Water	Dark Green	Safety Green	Circulating Water	Low Hazard		Green / White
Auxiliary Cooling Water	Dark Green	Safety Green	Auxiliary Cooling Water	Low Hazard		Green / White
Ash Sluice Water	Dark Green	Safety Green	Ash Water Supply	Hazardous	Pressure	Yellow / Black
FGD Reclaim Water	Light Green	5133V Green Lemon	Reclaim Water	Low Hazard		Green / White
Plant Heating	Light Blue	5182P Dawn Blue	Plant Heating	Low Hazard		Green / White
Fire Protection:						
Fire Water	Red	Safety Red	Fire Water	Fire Quenching Mat'l		Red / White
Carbon Dioxide	Red	Safety Red	Carbon Dioxide - Fire Quenching	Fire Quenching Mat'l		Red / White
Halon	Red	Safety Red	Halon	Fire Quenching Mat'l		Red / White
Compressed Air / Gases:						
Service Air	Dark Gray	5013P Warm Gary	Service Air	Low Hazard		Blue / White
Instrument / Control Air (see Note 3)	Light Gray	5015R Frost Gray	Instrument Air	Low Hazard		Blue / White
Nitrogen	Light Gray	5015R Frost Gray	Nitrogen Gas	Low Hazard		Blue / White

Table TSS - 7 Paint Colors						
	Base Piping Color	Porter Paint # or Sherwin Williams	Legend	Safety Rating	Hazard	Label / Letter Colors
Carbon Dioxide (other than fire protection.)	Light Gray	5015R Frost Gray	Carbon Dioxide	Low Hazard		Blue / White
Hydrogen	Dark Orange	5072X Red Orange	Hydrogen Gas	Hazardous	Explosive	Yellow / Black
Oxygen	Dark Orange	5072X Red Orange	Oxygen	Hazardous	Explosive	Yellow / Black
Plant Chemical Systems:						
Sulfuric Acid	Light Yellow	5100T Yellow Bird	Sulfuric Acid	Hazardous	Corrosive	Yellow / Black
Hydrochloric Acid	Light Yellow	5100T Yellow Bird	Hydrochloric Acid	Hazardous	Corrosive	Yellow / Black
Sodium Hydroxide	Light Orange	Orange	Sodium Hydroxide	Hazardous	Corrosive	Yellow / Black
Hydrazine	Purple	Safety Purple	Hydrazine	Hazardous	Toxic	Yellow / Black
Ammonium Hydroxide	Purple	Safety Purple	Ammonium Hydroxide	Hazardous	Corrosive	Yellow / Black
Di / Tri Sodium phosphate	Purple	Safety Purple	Di/Tri Sodium phosphate	Hazardous	Pressure	Yellow / Black
Sodium Hypochlorite Bleach	Purple	Safety Purple	Sodium Hypochlorite Bleach	Hazardous	Toxic	Yellow / Black
Sodium Bromide	Purple	Safety Purple	Sodium Bromide	Low Hazard		Green / White
Chlorine	Purple	Safety Purple	Chlorine	Hazardous	Toxic	Yellow / Black
Cooling Water Scale Inhibitor	Purple	Safety Purple	Cooling Water Scale Inhibitor	Hazardous	Corrosive	Yellow / Black
Cooling Water Corrosion Inhibitor	Purple	Safety Purple	Cooling Water Corrosion Inhibitor	Hazardous	Corrosive	Yellow / Black

Table TSS - 7 Paint Colors						
	Base Piping Color	Porter Paint # or Sherwin Williams	Legend	Safety Rating	Hazard	Label / Letter Colors
Dibasic Acid (DBA)	Purple	Safety Purple	DBA	Hazardous	Corrosive	Yellow / Black
Sodium Carbonate (Soda Ash)	Purple	Safety Purple	Soda Ash	Hazardous	Corrosive	Yellow / Black
Emulsified Sulfur	Purple	Safety Purple	Emulsified Sulfur	Low Hazard		Green / White
Anhydrous Ammonia Liquid and Vapor	Purple	Safety Purple	Anhydrous Ammonia	Hazardous	Corrosive	Yellow / Black
PAC (powered activated carbon)	Medium Blue	SW 4064 Amerlock LG&E Pac Blue	PAC			
Hydrated Lime / Calcium Hydroxide (DSI)	Light Tan	SW 4004	Calcium Hydroxide			
FGD Process / Byproduct Slurry:						
FGD Limestone Makeup Slurry	Peach	5078P Canyon Pink	Limestone Slurry	Low Hazard		Green / White
FGD Lime Makeup Slurry	Peach	5078P Canyon Pink	Lime Slurry	Low Hazard		Green / White
FGD Recycle Slurry	White	5003P White Feather	FGD Slurry	Low Hazard		Green / White
FGD Byproduct / Gypsum Slurry	White	5003P White Feather	Gypsum Slurry	Low Hazard		Green / White
Lubrication Oil Systems:						
Lube Oil	Dark Yellow	Safety Yellow	Lube Oil	Low Hazard		Green / White
Turbine Oil	Dark Yellow	Safety Yellow	Turbine Oil	Low Hazard		Green / White
Seal Oil	Dark Yellow	Safety Yellow	Seal Oil	Low Hazard		Green / White

Table TSS - 7 Paint Colors						
	Base Piping Color	Porter Paint # or Sherwin Williams	Legend	Safety Rating	Hazard	Label / Letter Colors
EHC System:						
EHC Fluid	Stainless	N/A	EHC Fluid	Hazardous	Pressure	Yellow / Black
Fuel Systems:						
Pulverized Coal	Black	5008R Jet Black	Pulverized Coal	Low Hazard		Blue / White
Fuel Oil	Dark Yellow	Safety Yellow	Fuel Oil	Low Hazard		Green / White
Diesel Fuel	Dark Yellow	Safety Yellow	Diesel Fuel	Low Hazard		Green / White
Gasoline	Dark Yellow	Safety Yellow	Gasoline	Hazardous	Flammable	Yellow / Black
Natural Gas	Dark Orange	5072X Red Orange	Natural Gas	Hazardous	Flammable	Yellow / Black
Vacuum Systems:						
Condenser Air Removal Vacuum System	Mauve	5209R Mauve Dusk	Condenser Air Removal	Low Hazard		Blue / White
Sludge Dewatering Vacuum System	Mauve	5209R Mauve Dusk	Sludge Dewatering Vacuum	Low Hazard		Blue / White
Waste Handling Systems:						
Sanitary Sewers	Dark Brown	5061P Yellow Brown	Sanitary Sewers	Low Hazard		Green / White
Fly Ash Transfer	Light Brown	5225P Beach Stone PPPC-745 Weathered Marble	Fly ash	Low Hazard		Green / White
Bottom Ash	Light Brown	5225P Beach Stone	Bottom Ash	Low Hazard		Green / White
Building Sumps	Dark Aqua	5162P Classic Aqua	Building Sumps	Low Hazard		Green / White

Table TSS - 7 Paint Colors						
	Base Piping Color	Porter Paint # or Sherwin Williams	Legend	Safety Rating	Hazard	Label / Letter Colors
Roof Drains	Dark Aqua	5162P Classic Aqua	Roof Drains	Low Hazard		Green / White
Building Siding – Match Existing:						
TC1 WFGD FRP Siding; If agreed Aluminum Flashing/Corner Supports (See Notes 1, 2)	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
For FRP Siding - if agreed Aluminum Flashing/Corner Supports	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
Painted Aluminum	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
PJFF: Electrical & Mechanical	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
PJFF PAC Blower Bldg.	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
T+T Buildings:						
Transfer Towers	Berkshire Green	PPG				
Electrical, Maintenance	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
Plant Structures:						
Handrails	Porter Safety Yellow	IPC 875 Carboline 6666 Fly Ash Bg Ld	-	Low Hazard	-	-
Silo (depends on content):						
TC2 HL Silo	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
TC1 PAC Silo	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		

Table TSS - 7 Paint Colors						
	Base Piping Color	Porter Paint # or Sherwin Williams	Legend	Safety Rating	Hazard	Label / Letter Colors
T+T Fly ash	Light Tan	SW 4004 (Tannery)	To match TC1 HL silos	Low Hazard		
Pipe Rack Steel (depends on location):						
Fly ash Barge Loading	Light Brown	5225P Beach Stone		Low Hazard		Green / White
Pipe Rack U2 to BAP	Berkshire Green	PPG				
T+T Pipe Rack	Berkshire Green	PPG				
PJFF & PAC Support Steel	Light Grey	Carboline Light Gray, C705		Low Hazard		
PJFF Misc. Elements:						
Poppet isle checkered plate	Dark Gray	PP # 5015R Frost Gray		Low Hazard		
Air cylinder pedestals						

Notes:

1. Fiberglass flashing to be utilized where possible. Wall penetrations and misc. flashings to be field fabricated for optimum fit from 24-gauge steel flat stock.
2. Stainless steel screws, butyl and neoprene closures to be used as necessary.
3. Instrument air piping that is stainless generally requires no coating for protection.

TSS-8 Site Drawings

Various drawings and sketches in **Exhibit A1 Appendix A** and **Exhibit A2 Appendix A** are provided by the Owner that indicate the required equipment layout, flow diagrams, offices, storage laydown areas, fabrication areas, utility connections, site access points, existing facilities and other features to the Site.

TSS-9 Limestone Analysis

Active Ingredient	% Guaranteed
CaCO3	90% Min
MgCO3	6% Max
Inerts	7% Max



EXHIBIT T
TERMINAL POINTS LIST TO EXISTING PLANT

The following terminal points below and in **Exhibit T Table 1** define the terminations or the start as the case may be, of Contractor's scope. Modification to the locations of those terminal points required by Owner shall be at no additional cost provided that the revised termination is consistent with the tie-in point definitions below. Contractor shall include an easily accessible isolation valve at each terminal point for each piping system. Additional or other interface points may be required or available based upon approval by Owner.

1. Mechanical

- a. See **Exhibit T Table 1** for details.

2. Electric and Communications

- a. For temporary power used during construction from the Owner distribution network or disconnect switch, the Contractor shall provide its cables via underground ductbanks to its electrical equipment. No overhead wiring or distribution poles are allowed. Contractor shall provide to Owner fuse sizes to protect Contractor provided cable and transformers. Contractor shall account for any phase shift between the two sources provided by Owner in Contractor's design.
- b. For permanent power, the Contractor shall route via underground ductbanks, conduit or cable tray. No overhead wiring or distribution poles are allowed.
- c. The plant communications and paging system shall be extended to a mutually agreed tie in point.
- d. See **Exhibit T Table 1** for additional details.

3. Controls and Instrumentation

- a. All programmable logic controller (PLC) or microprocessor-based control packages supplied shall be capable of remote control and monitoring from Owner's distributed control system (DCS). If the control package includes 20 or more I/O points, the interface with the DCS shall be through Ethernet communications with all alarm, control and monitoring parameters controllable and retrievable through the interface.
- b. The Contractor shall route via underground ductbanks, conduit or cable tray. No overhead wiring or distribution poles are allowed.
- c. DCS Controls
 - i. Fly Ash Handling Systems
 - ii. Bottom Ash Handling Systems
 - iii. Synthetic Gypsum System
- d. See **Exhibit T Table 1** for additional details.

4. Roadways

- a. Work on roadways shall be coordinated with Owner to minimize the effect to normal plant operations and other on-going construction projects at the site.



DESCRIPTION	CONNECTION NO.	DESIGN PRESSURE	DESIGN TEMPERATURE	MATERIAL	CONNECTION TYPE	SIZE	PROCESS	DRAWING REFERENCE	LOCATION	REMARK	
Amec Foster Wheeler											
Mechanical											
M1	Unused										
M2	Dense Phase Transport Purge Air Line	T-HATBD	Existing - TBD New - Max. 150 PSIG	Existing - TBD New - Max. 150 F	Existing - CS New - SS	TBD by CONTRACTOR	Existing - 6" New - 6"	Purge Air	TC0-M0SK4-0005	Existing purge airline between 1200 and 5000 Ton Silos	The new purge air line follows the new dense phase ash conveying line all the way to new CCRT Fly Ash Silos.
M3	Unit 1 Economizer ash vacuum line	T-F14	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 12" New - 12"	Fly Ash System	- PC-Q07132-003 - PM-Q07132-006 sht. 1 of 3	Approx. EL. 569'-1 3/8" near column K-15	Tie into TC1 existing 12" riser at EL. 569' - 1 3/8" near column K-15.
M4	Unit 2 air preheater and economizer ash vacuum line	T-F15	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 8" New - 8"	Fly Ash System	- PC-Q07132-004 - PM-Q07132-006 sht. 2 of 3	Approx. EL. 569'-1 3/8" near column K-15	Tie into existing 8" line coming from Unit 2 Fabric Filter Hoppers, and redirect flow to Unit 2 Transfer Station
M5	Water treatment building washdown pump discharge	T-F13	Existing - By Owner New - Max. 90 PSIG	Existing - By Owner New - Max. 180 °F	Existing - TBD New - CS	TBD by CONTRACTOR	Existing - 4" New - 4"	Bottom Ash Slurry	- TC0-M-SK115 - PM-Q07132-006 sht. 3 of 3 (UCC Drawing with Amec FW redlines)	Water Treatment Building	Tie into existing 4" to supply backup water for ash conditioners in the new fly ash silos.
M6	Unit 1 Economizer ash vacuum line	T-F01	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 9" New - 12"	Fly Ash System	- TC1-M-SK120 - M10115 - 510-55415-4 - PM-Q07132-006 sht. 1 of 3 - PC-Q07132-003	Approx. EL. 576' near column K-15	Tie into TC1 economizer ash vacuum line prior to air separator tank and route dry line to existing 12" riser (T-F14) at Approx. EL. 569' - 1 3/8" near column K-15.
M7	Unit 1 Air Preheater and Economiser ash vacuum line	T-F02	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 12" New - 12"	Fly Ash System	- PC-Q07132-003 - PM-Q07132-006 sht. 1 of 3	Approx. EL. 507'- 6 3/8" near column B-17	Tie into existing Dry ESP line to hydroveyor and redirect flow to TC1 Transfer Station.
M8	Unit 1 Dry ESP 'A' fly ash vacuum line	T-F03	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 10" New - 12"	Fly Ash System	- PC-Q07132-003 - PM-Q07132-006 sht. 1 of 3	Approx. EL. 476' - 5 7/16" near column H-9	Tie into TC1 dry ESP 'A' fly ash vacuum line prior to 1200 ton silo and route to new TC1 transfer station
M9	Unit 1 Dry ESP 'B' fly ash vacuum line	T-F04	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 12" New - 12"	Fly Ash System	- PC-Q07132-003 - PM-Q07132-006 sht. 1 of 3	Fly Ash pipe rack north of 1200 ton silo, approx. EL. 498'-10"	Tie into TC1 dry ESP 'B' fly ash vacuum line prior to 1200 ton silo and route to new TC1 transfer station
M10	Unit 1 PJFF 'A' fly ash vacuum line	T-F05	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 12" New - 14"	Fly Ash System	- PC-Q07132-003 - PM-Q07132-006 sht. 1 of 3	Approx. EL. 505' - 6 1/8" near column J-17	Tie into TC1 PJFF 'A' fly ash vacuum line and route to new TC1 transfer station

DESCRIPTION	CONNECTION NO.	DESIGN PRESSURE	DESIGN TEMPERATURE	MATERIAL	CONNECTION TYPE	SIZE	PROCESS	DRAWING REFERENCE	LOCATION	REMARK	
Amec Foster Wheeler											
M11	Unit 1 PJFF 'B' fly ash vacuum line	T-F06	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 12" New - 14"	Fly Ash System	- PC-Q07132-003 - PM-Q07132-006 sht. 1 of 3	Approx. EL. 505' - 6 1/8" near column J-17	Tie into TC1 PJFF 'B' fly ash vacuum line and route to new TC1 transfer station
M12	Unit 2 air preheater and economizer ash vacuum line	T-F07	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 8" New - 8"	Fly Ash System	- PC-Q07132-004 - PM-Q07132-006 sht. 2 of 3	Approx. EL. 570' near column P-6.4	Tie into TC2 air preheater and economizer ash vacuum lines prior to air separator tank and route to existing 8" line (T-15) coming from Unit 2 Fabric Filter Hoppers at Approx. EL. 570' near column P-6.4
M13A	Unit 2 PJFF fly ash vacuum line	T-F08A	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 8" New - 8"	Fly Ash System	- PC-Q07132-004 - PM-Q07132-006 sht. 2 of 3	Approx. EL 506' - 0 3/4" near column Q-43.9	Tie into existing 8" line coming from Unit 2 Fabric Filter Hoppers, and redirect flow to Unit 2 Transfer Station
M13B	Unit 2 PJFF fly ash vacuum line	T-F08B	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 8" New - 8"	Fly Ash System	- PC-Q07132-004 - PM-Q07132-006 sht. 2 of 3	Approx. EL 506' - 0 3/4" near column Q-43.9	Tie into existing 8" line coming from Unit 2 Fabric Filter Hoppers, and redirect flow to Unit 2 Transfer Station
M14	Unit 2 Dry ESP 'A' fly ash vacuum line	T-F09	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 12" New - 14"	Fly Ash System	- PC-Q07132-004 - PM-Q07132-006 sht. 2 of 3	Fly ash pipe rack north of TC1 ESP 'A'	Tie into TC2 ESP 'A' fly ash vacuum line prior to 1200T Common Silo and route to new TC2 transfer station
M15	Unit 2 Dry ESP 'B' fly ash vacuum line	T-F10	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Centrifugally-cast chrome-iron (Nuvalloy)	TBD by CONTRACTOR	Existing - 12" New - 14"	Fly Ash System	- PC-Q07132-004 - PM-Q07132-006 sht. 2 of 3	Fly ash pipe rack north of TC1 ESP 'A'	Tie into TC2 ESP 'B' fly ash vacuum line prior to 1200T Common Silo and route to new TC2 transfer station
M16	Common fly ash dense phase from 1200 ton silo to T&T silos	T-F11	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Carbon steel (with wear resistant elbows)	TBD by CONTRACTOR	Existing - 10" New - 10"	Fly Ash System	- PC-Q07132-002 - PM-Q07132-006 sht. 3 of 3	Dense phase fly ash pipe rack north west of 1200 ton silo	Tie into existing dense phase line with lateral as shown on DWG TC0-M-02512
M14	Common fly ash dense phase from 5000 ton silo to T&T silos	T-F12	TBD by CONTRACTOR	TBD by CONTRACTOR	Existing and New - Carbon steel (with wear resistant elbows)	TBD by CONTRACTOR	Existing - 10" New - 10"	Fly Ash System	- PC-Q07132-002 - PM-Q07132-006 sht. 3 of 3	Dense phase fly ash pipe rack north of 5000 ton silo	Tie into existing dense phase line with lateral as shown on DWG TC0-M-02513
M15	Unit 1 WWFGD Bleed line to Bottom Ash Pond	T-GP1	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	8"	Gypsum Dewatering	- TC0-M-SK130 - 15284-3E-4628 - TC0-M-SK5-001	HIDPE line running beneath pipe rack east of Unit 2 hyperbolic cooling tower	Tie into existing WWFGD Bleed line running beneath pipe rack east of Unit 2 hyperbolic cooling tower. Add isolation valve downstream to redirect flow to new gypsum dewatering facility.

DESCRIPTION	CONNECTION NO.	DESIGN PRESSURE	DESIGN TEMPERATURE	MATERIAL	CONNECTION TYPE	SIZE	PROCESS	DRAWING REFERENCE	LOCATION	REMARK	
Amec Foster Wheeler											
M16	Unit 2 WWFGD Bleed line to Gypsum Storage Pond	T-GP2	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	8"	Gypsum Dewatering	- TC0-M-SK130 - TC2-M-00006-QSD09 - TC0-M-SK5-001	HDPE line running beneath pipe rack east of Unit 2 hyperbolic cooling tower	Tie into existing WWFGD Bleed line running beneath pipe rack east of Unit 2 hyperbolic cooling tower. Add isolation valve downstream to redirect flow to new gypsum dewatering facility.
M17	Reclaim water to Bottom Ash Pond	T-GP3	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	8"	Gypsum Dewatering	- TC0-M-SK134 - 15284-3E-4628 - TC0-M-SK5-001	HDPE line running beneath pipe rack east of Unit 2 hyperbolic cooling tower	Tie into existing WWFGD Bleed line running beneath pipe rack east of Unit 2 hyperbolic cooling tower. Add isolation valve downstream to redirect flow to new gypsum dewatering facility.
M18	Reclaim water to Unit 1 WWFGD module 1A1	T-GP4	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	8"	Gypsum Dewatering	- TC0-M-SK137 - 15284-3E-4615 - TC0-M-SK5-005	West of absorber module 1A1 near platform elevation 519'-1-1/4"	Replace remainder of existing carbon steel line with FRP to each vessel
M19	Reclaim water to Unit 1 WWFGD module 1B2	T-GP5	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	8"	Gypsum Dewatering	- TC0-M-SK137 - 15284-3E-4615 - TC0-M-SK5-005	West of absorber module 1B2 near platform elevation 519'-1-1/4"	Replace remainder of existing carbon steel line with FRP to each vessel
M20	Reclaim water to Gypsum Storage Pond	T-GP6	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	12"	Gypsum Dewatering	- TC0-M-SK136 - TC2-M-00006-QSD09 - TC0-M-SK5-001	HDPE line running beneath pipe rack east of Unit 2 hyperbolic cooling tower	Tie into existing WWFGD Bleed line running beneath pipe rack east of Unit 2 hyperbolic cooling tower.
M21	Reclaim water to Unit 2 WFGD Makeup	T-GP7	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	10"	Gypsum Dewatering	- TC0-M-SK135 - TC2-M-00006-QSD01 - TC0-M-SK5-005	Southwest of Unit 2 absorber vessel near platform elevation 539'-0"	Connect to Reclaim Water line prior to flow meter 2-QRW-FT-110
M22	Unit 1 WWFGD Bleed line to Bottom Ash Pond	T-GP8	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	8"	Gypsum Dewatering	- TC0-M-SK130 - 15284-3E-4628 - TC0-M-SK5-001	HDPE line running beneath pipe rack east of Unit 2 hyperbolic cooling tower	Tie into existing WWFGD Bleed line running beneath pipe rack east of Unit 2 hyperbolic cooling tower. Add isolation valve downstream to redirect flow to new gypsum dewatering facility.
M23	Unit 2 WWFGD Bleed line to Gypsum Storage Pond	T-GP9	200 PSIG Max	140°F Max	Fiberglass Reinforced Plastic	TBD by CONTRACTOR	8"	Gypsum Dewatering	- TC0-M-SK130 - TC2-M-00006-QSD09 - TC0-M-SK5-001	HDPE line running beneath pipe rack east of Unit 2 hyperbolic cooling tower	Tie into existing WWFGD Bleed line running beneath pipe rack east of Unit 2 hyperbolic cooling tower. Add isolation valve downstream to redirect flow to new gypsum dewatering facility.
M24	Fire Protection Buried Main	T-FP1	230 PSIG (Max)	110 F	HDPE DR 9 4710 PE	TBD by CONTRACTOR	12"	Fire Water	TC-C-12 M00105 M00606	Buried fire loop south of mechanical cooling tower (locations as required for new design)	Contractor to determine the number of connections and locations as required by design
M25	Fire Protection Buried Main	T-FP2	230 PSIG (Max)	110 F	HDPE DR 9 4710 PE	TBD by CONTRACTOR	12"	Fire Water	TC-C-12 M00105 M00606	Buried fire loop south of mechanical cooling tower (locations as required for new design)	Contractor to determine the number of connections and locations as required by design
M26	Fire Protection Buried Main	T-FP3	230 PSIG (Max)	110 F	HDPE DR 9 4710 PE	TBD by CONTRACTOR	12"	Fire Water	TC-C-12 M00105 M00606	Buried fire loop south of mechanical cooling tower (locations as required for new design)	Contractor to determine the number of connections and locations as required by design
M27	Fire Protection Buried Main	T-FP4	230 PSIG (Max)	110 F	HDPE DR 9 4710 PE	TBD by CONTRACTOR	12"	Fire Water	TC-C-12 M00105 M00606	Buried fire loop south of mechanical cooling tower (locations as required for new design)	Contractor to determine the number of connections and locations as required by design

DESCRIPTION	CONNECTION NO.	DESIGN PRESSURE	DESIGN TEMPERATURE	MATERIAL	CONNECTION TYPE	SIZE	PROCESS	DRAWING REFERENCE	LOCATION	REMARK
Amec Foster Wheeler										
M28	Fire Protection Buried Main	T-FP5	230 PSIG (Max)	110 F	HDPE DR 9 4710 PE	TBD by CONTRACTOR	12"	Fire Water	TC-C-12 M00105 M00606	Buried fire loop south of mechanical cooling tower (locations as required for new design) Contractor to determine the number of connections and locations as required by design
M29	Unused									
M30	Unused									
M31	Unused									
M32	Unused									
M33	Service Water (CCRT Area)	T-SW1	100 PSIG (Max)	110 F	Existing - TBD New - HDPE	TBD by CONTRACTOR	Existing - TBD New - 12"	Service Water	- M00606 - TC0-M-SK2-0001	TBD by CONTRACTOR based on mutually agreed location approved by Owner Contractor to locate nearest tie-point to existing service water header.
M34	Service Water (Unit 1 Boiler Area)	T-SWTBD	Existing - TBD New - Max. 250 PSIG	Existing - TBD New - Max. 110 F	Existing - TBD New - CS	TBD by CONTRACTOR	Existing - TBD New - 3"	Service Water	TC0-M-SK2-0001	TBD by CONTRACTOR based on mutually agreed location approved by Owner Tie-in to existing service water line for supply to Unit 1 Submerged Chain Conveyor
M35	Potable Water (CCRT Area)	T-PW1	Existing - By Owner New - Max. 100 PSIG	Existing - By Owner New - Max. 110 F	Existing - TBD New - HDPE	TBD by CONTRACTOR	Existing - 4" New - 2"	Potable Water	TC0-M-SK3-0000	TBD by CONTRACTOR based on mutually agreed location approved by Owner Contractor to locate nearest tie-point to existing potable water header.
M36	Potable Water (Truck Loading Station)	T-PW2	Existing - By Owner New - Max. 100 PSIG	Existing - By Owner New - Max. 110 F	Existing - TBD New - HDPE	TBD by CONTRACTOR	Existing - TBD New - 2"	Potable Water	TC0-M-SK3-0000	TBD by CONTRACTOR based on mutually agreed location approved by Owner Contractor to locate nearest tie-point to existing potable water header.
M37	Sanitary Sewer (Existing Lift station)	T-SS1	TBD by CONTRACTOR	TBD by CONTRACTOR	TBD by CONTRACTOR (HDPE for new pipe)	TBD by CONTRACTOR	Existing - 4" New - 4"	Sanitary Sewer	TC-C-12 TC0-M-SK210	TBD by CONTRACTOR based on mutually agreed location approved by Owner Contractor to locate nearest tie-point to existing sanitary sewer header.
M38	Unused									
M39	Reclaim Water (Future Limestone Grinding Makeup) - Unit 1 and Unit 2	N/A	TBD by CONTRACTOR	TBD by CONTRACTOR	TBD by CONTRACTOR	TBD by CONTRACTOR	14" Flange	Gypsum Reclaim Water	TC0-M-SK5-0005	Pipe to end on pipe rack southwest of WFGD building Use existing pipe racks for pipe routing
M40	Reclaim Water (Future Waste Water Treatment) - Unit 1 and Unit 2	N/A	TBD by CONTRACTOR	TBD by CONTRACTOR	TBD by CONTRACTOR	TBD by CONTRACTOR	14" Flange	Gypsum Reclaim Water	TC0-M-SK5-0005	Pipe to end on pipe rack east of existing water treatment building Use existing pipe racks for pipe routing

DESCRIPTION	CONNECTION NO.	DESIGN PRESSURE	DESIGN TEMPERATURE	MATERIAL	CONNECTION TYPE	SIZE	PROCESS	DRAWING REFERENCE	LOCATION	REMARK	
Amec Foster Wheeler											
Electric and Communication											
E1	Grounding - new ground grids shall be connected to existing, adjacent ground grids by a minimum of two ground cables routed in separate paths.	TC-E1	NA	NA	Copper conductors	Exothermic below grade, compression type above grade	250 kCMIL	NA	NA	TBD by CONTRACTOR	Contractor to locate tie-points to existing ground grids.
E2	Gai-tronics Communication interface to existing system.	TC-E2	NA	NA	Gai-tronics to match existing system	TBD by CONTRACTOR	NA	NA	NA	TBD by CONTRACTOR based on mutually agreed location approved by Owner	Tie-in includes paging and party circuits only. Power shall come from Contractor provided sources.
E3	Raceway and cable for telephone/LAN equipment	TC-E3	NA	NA	12 Fiber per cable minimum	TBD by CONTRACTOR	NA	NA	NA	TBD by CONTRACTOR based on mutually agreed location approved by Owner	
E4	Fire Alarm	TC-E4	NA	NA	Copper conductors	TBD by CONTRACTOR	TBD by CONTRACTOR	NA	NA	TBD by CONTRACTOR based on mutually agreed location approved by Owner	Owner's existing fire alarm panel is Honeywell.
E5	15 kV cable connections to Station Feeder 14kV Busses A & B on breakers currently used for Ash Pond feeders.	TC-E5	NA	NA	Copper conductors	NEMA Lugs	TBD by CONTRACTOR	NA	TC0-E-SK101	Station Feeder 14 kV Busses A& B Ash Pond feeder breakers.	Feeder shall be sized for 1200 A routed through the existing duct banks. Contractor shall verify there are no adverse affects on the existing cables.
E6	Demolition of existing Ash Pond 14 kV feeder cables.	TC-E6	NA	NA	NA	NA	NA	NA	NA	NA	Demolition shall include complete removal of cables.
E7	15 kV cable connections to existing Unit 1, 7 kV bus to feed new Ash Switchgear to be within the existing plant area.	TC-E7	NA	NA	Copper conductors	NEMA Lugs	TBD by CONTRACTOR	NA	TC0-E-SK103	UNIT 1 7kV BUS SDRS 1B1 1B4-6A	Contractor to locate location for new switchgear.
E8	15 kV cable connections to existing Unit 2, 7 kV bus to feed new Ash Switchgear to be within the existing plant area.	TC-E8	NA	NA	Copper conductors	NEMA Lugs	TBD by CONTRACTOR	NA	TC0-E-SK103	UNIT 2 7kV BUS 2B1 270B1-06A	Contractor to locate location for new switchgear.
E9	Temporary Power Interface	TC-E9	NA	NA			TBD by CONTRACTOR	NA	NA	TBD by CONTRACTOR based on mutually agreed location approved by Owner	Temporary power shall be removed upon completion or when no longer needed in the area.
E10	480V cable connections or MCC section addition to Existing Unit 1 MCCs for new under boiler submerged chain conveyor.	TC-E10	NA	NA	Copper conductors or new MCC section	NEMA Lugs or MCC bus extension	TBD by CONTRACTOR	NA	NA	TBD by CONTRACTOR based on mutually agreed location approved by Owner	Contractor to determine possible sources from load studies. New MCC buckets and sections shall be added as needed for power feeds to new equipment.
Controls and Instrumentation											
IC1	Terminate New Control Equipment to Existing DCS Fanout Switches	TC-IC1	N/A	N/A	Fiber	ST/ST	50/125um	N/A	TC0-E-SK104	Existing Plant DCS Electrical Room	As Required by Design
IC2	Terminate New Control Equipment to Existing DCS Fanout Switches	TC-IC2	N/A	N/A	Fiber	ST/ST	50/125um	N/A	TC0-E-SK104	Existing Plant DCS Electrical Room	As Required by Design
IC3	Terminate New Control Equipment to Existing DCS Fanout Switches	TC-IC3	N/A	N/A	Fiber	ST/ST	50/125um	N/A	TC0-E-SK104	Existing Plant DCS Electrical Room	As Required by Design

J. A. R.

EXHIBIT U TRAINING

Contractor will develop and implement a Job Site-based comprehensive training program for Owner's operating and maintenance (O&M) personnel to understand the overall integrated operation and maintenance of the CCR Treatment System. O&M personnel will be required to pass the training course prior to operating or maintaining the CCR Treatment System.

The training program will consist of Job Site classroom training and instruction for Owner's O&M personnel, followed by on-the-job training through Commercial Operation. The level of detail and pace of this training program will be based on the assumption that Owner's personnel being trained have some knowledge and experience with power plants and power plant components and require only orientation to the specific operational requirements of the new Equipment.

Training for Equipment provided in Agreement will be provided by the Contractor. Training shall be coordinated and scheduled to provide an overall comprehensive training program for the CCR Treatment System.

Within 6 months of start-up, Contractor will prepare and submit the training program and preliminary schedule to Owner for review and approval. It is expected that classroom training will begin approximately 8 weeks before and complete no later than the start of the CCR Treatment System, and Owner should ensure the availability of all nominated personnel requiring training at that time. Training instructors may be required to conduct training during afternoon or midnight shifts.

Classroom Training

The formal training classes shall be conducted by an experienced instructor using well-organized training manuals and materials (including video presentations) prepared by the Contractor that have been specifically prepared for the Project. Training materials shall be submitted in accordance with Exhibit X for Owner to concur for suitability. The Owner's operations, maintenance, and service personnel will be in attendance. The training sessions shall include classroom discussion on the theory of operation of the project, as well as maintenance and service methods for the project Equipment.

Contractor's training materials will be based on system descriptions, each containing an operations section with a basic description of systems and Equipment operations. Contractor's training materials will also provide a basic description of several modes of integrated plant operations. The level of detail provided in these materials will address any detailed step-by-step sequence action required by the operators. An alarm response section will address those alarms for which the appropriate operator response may not be obvious.

The Owner may decide to record the training sessions at its expense and shall have the right to use such recordings and all other training materials for future training of personnel.

Web based training is not acceptable.

Lesson Plan Outline

The student's lesson text will incorporate the following elements:

- Course objectives – what the student is required to learn
- System overview – what the system does and how it works
- Major component description – functional description
- Flow path and controls – major flow paths, instrumentation, protective devices, controls, and interlocks
- Principles of operation
- Startup, normal operation, shutdown, and infrequent operation procedures
- Alarm responses
- Support systems – systems needed for operations
- Hazards and safety features
- Routine maintenance and service methods
- Hardware layout and functions
- Power and control wiring
- Diagnostic interfaces, keypad/display interface
- Software mapping, programming, setup, configuration, control loop tuning, operational indicators, faults, diagnostic tools
- Emergency procedures (including risk, abnormal situations and lessons learned)
- Troubleshooting and preventative maintenance
- Figures and tables (as required)

Contractor trainers will present those portions of the classroom training that are prepared by Contractor (approximately 50 percent of the training). The remainder of the classroom training will be presented by the original Equipment manufacturers (OEMs), major Equipment and system vendors, or Subcontractors. Contractor will arrange for, schedule, and coordinate the classroom training presented by OEMs/Subcontractors.



The classroom training provided by the Contractor/vendors/Subcontractors will cover the following Equipment and systems:

CCR Treatment Systems:

Gypsum

- Gypsum Vacuum Belts
- Portal Scraper Reclaimer
- Gypsum Transfer and Shuttle Conveyors

Fly Ash

- Fly Ash Conditioners (Pug Mills)
- Vacuum to Pressure System Equipment

Bottom Ash

- Unit 1 Local Bottom Ash System
- Apron Belt Feeder
- Bottom Ash Transfer Conveyor

Pipe Conveyor

Leachate Pump System

- Electrical Equipment
- Auxiliary Systems

Additionally, Contractor shall bring in manufacturer's representatives to train O&M personnel on key Equipment.

Student Evaluations

Up-to-date records reflecting each student's progress, including test results and attendance, will be submitted to Owner upon completion of each training course for review and evaluation.

Materials

Contractor will provide training materials, manuals, slides, films, and other instructional material as may be necessary for training.

Training aids, such as films, slides, computer presentations, computer-simulated process interactive videos, and software packages/materials, along with supplies necessary to support, maintain, and successfully supplement the training program, will be furnished and then turned over to Owner at completion.

Training materials shall also include electronic Microsoft (MS) Excel files of the spare parts list, bill of materials, instrument list, and valve list, and any other lists of components supplied by the

Contractor. Contractor shall coordinate provision of all training materials with those from the Owner's and Contractor's Equipment suppliers.

The Contractor shall provide each trainee with a full set of materials used in the classroom presentations. These materials will be retained by each trainee for future reference. Five additional hard copy sets and a compact disk (CD) in MS Word, or MS Excel where appropriate, format shall also be provided. An electronic PDF file of the operations and maintenance manual and training materials shall be included as well and shall be searchable and include bookmarked sections. Materials shall include actual manuals for the Equipment and drawings and schematics of Equipment supplied for the Project.

Facilities

Training will be conducted at the Job Site or other mutually agreed upon location.

On-The-Job Training

The Owner considers on-the-job training an essential part of an overall training program. During the commissioning phase, Owner's O&M staff will work closely with the Contractor's startup team and the OEM technical advisors. This will give the O&M staff an opportunity to convert knowledge gained in the classroom to practical experience in the plant by assisting with hands-on activities such as preoperational system valve lineups. In addition, the Contractor will involve Owner's O&M personnel during the development of the operating procedures and allow active participation in writing detailed sequences of actions required for basic integrated operations, such as cold start to full load, hot restart, normal shutdown, and response to plant abnormal conditions.



EXHIBIT V

OPERATING AND MAINTENANCE MANUAL REQUIREMENTS

1. OPERATING AND MAINTENANCE MANUALS SUBMITTAL INSTRUCTIONS

- A. In addition to electronic Submittals specified in Exhibit X, Equipment instruction books and operating manuals prepared by each equipment supplier and the Contractor shall include the following:
1. Index and tabs
 2. Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers
 3. Matrix of all regularly scheduled maintenance requirements
 4. Applicable drawings
 5. Warranties and guarantees
 6. Name and address of nearest manufacturer-authorized service facility
 7. All additional data specified
- B. Information listed above shall be bound into hard-back binders. Four complete sets of binders shall be provided. Binders shall be heavy duty Bok-Hinge Split Prong, McBee Swing Hinge or Crane Binder Technologies post type binders or approved equal. Sheet size shall be 8-1/2" x 11". Binder color shall be black. Capacity shall be a minimum of three inches, but sufficient to contain and use sheets with ease.
1. Provide the following accessories:
 - a. Label holder
 - b. Business card holder
 - c. Sheetlifters
 - d. Horizontal pockets
 2. The following information shall be imprinted, inserted, or affixed by label on the binder front cover:
 - a. Owner's name, Owner's facility or plant name, and Project name
 - b. Manual type
 - c. Equipment item name or System
 - d. Agreement number
 - e. Volume number (if applicable)
 - f. Manufacturer's name and address
 3. The following information shall be imprinted, inserted, or affixed by label on the binder spine (abbreviations are acceptable):
 - a. Owner's name, Owner's facility or plant name, and Project name
 - b. Equipment item name or System
 - c. Agreement number
 - d. Volume number (if applicable)
 4. Submit mockup of binder front cover and spine for Owner's review and approval as shown in Figure 1.

Figure 1
TYPICAL INSTRUCTION BOOK OR OPERATING MANUAL COVER AND SPINE LAYOUT

LG&E/KU	LG&E/KU	22
TC	TRIMBLE COUNTY - CCRT	18
CCRT	(Treatment)¹	
_____	(Instruction Book) (Operating	18
EQUIPMENT³	Manual)²	
	For	
Agreement	_____ System³	20
Number	Agreement Number _____	
_____	Volume Number⁴ _____	16
	Manufacturer's Name	22
Volume	Manufacturer's Address	18
Number⁴		

(Spine)

(Cover)

NOTES:

1. Choose either "Treatment System" or "Transportation System" or "Unit 1 SCC"
2. Choose either "Instruction Book" or "Operating Manual."
3. Choose either Flyash, Bottom Ash, Gypsum, Pipe Conveyor, Leachate or Other (to be determined later)
4. Volume number required only if instructions are contained in more than one volume.
5. All lettering shall be a block style font, imprinting color to contrast with binder color specified.
6. Cover lettering shall be point sizes indicated in column to right of cover illustration.
7. Spine letter shall be 14-point minimum.

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EXHIBIT W
WORK BREAKDOWN STRUCTURE

1. Reference: Agreement Section 8.15, Tax and Accounting Information.
2. The Work Breakdown Structure (WBS) must be provided upon Final Completion for each Subproject. Common must be provided upon completion of the last Subproject at Final Completion. The WBS is subject to change.
3. For removal (demolition) the same numbers are used but state "Removal".
4. Removal cost should be reported with the applicable Milestone.
5. **ACCOUNT 131100 - STRUCTURES AND IMPROVEMENTS:** This account shall include the cost in place of structures and improvements used in connection with steam power generation.
6. **ACCOUNT 131200 - BOILER PLANT EQUIPMENT:** This account shall include the cost installed of furnaces, boilers, coal and ash handling, and coal preparing equipment, steam and feedwater piping, boiler apparatus and accessories, used in the production of steam to be used primarily for generating electricity.
7. **ACCOUNT 131500 - ACCESSORY ELECTRIC EQUIPMENT:** This account shall include the cost installed of auxiliary generating apparatus, conversion equipment, and equipment used primarily in connection with the control and switching of electric energy produced by steam power, and the protection of electric circuits and equipment, except electric motors used to drive equipment included in other accounts. Such motors shall be included in the account in which the equipment with which they are associated is included.
8. **ACCOUNT 131600 - MISCELLANEOUS POWER PLANT EQUIPMENT:** This account shall include the cost installed of miscellaneous equipment in and about the steam generating plant devoted to general station use, and which is not properly includible in any of the foregoing steam-power production accounts.

GENERATION PLANT	
14kv Treatment and Transportation Feeds (@ the Switching Station) Switchgear (14kv) and Controls	
Fly Ash Subproject (new and removal)	
<u>Common Fly Ash</u>	
	Two Concrete Fly Ash Storage Silos @ 4,000 tons each
	Silo Common Elevator
	Ash Conditioners: 0A1, 0A2, 0B1, 0B2
	Silo Bin Vents 0A Fly Ash Shuttle Conveyor (BC-10A) 0B Fly Ash Shuttle Conveyor (BC-10B) 0C Fly Ash Shuttle Conveyor (BC-10C) 0D Fly Ash Shuttle Conveyor (BC-10D)
	Truck Scales
	Fly Ash Electrical, Air, Piping
	Fly Ash Silo Stair Towers, Ladders and Platforms
	Fly Ash Pipe Rack (20)

GENERATION PLANT	
Unit 1 and Unit 2	
	Wet Ash Handling Remove Unit 1 Wet Ash Piping/Hydroveyor Connection (piping and electrical) Remove Unit 2 Wet Ash Piping Hydroveyor Connection (piping and electrical)
	Unit 1 Dry Ash vacuum/dilute phase fly ash handling Equipment Unit 2 Dry Ash vacuum/dilute phase fly ash handling Equipment
	Unit 1 Electrical Building and Equipment: Switchgear/Lights/DCS (15) Unit 2 Electrical Enclosure and Equipment: Switchgear/Lighting/DCS (16)
	Dry Ash Piping (all piping and associated items run from the ash hoppers to the Storage Silos)
Transport Subproject	
	Bottom Ash Transfer Tower TT-1 Building
	Truck Unloading Transfer Tower TT-5 Building
	Dual Truck Loading Station Enclosure Covered Emergency Waste Storage Pile Enclosure
	Electrical Building Termination End
	Pipe Conveyor (PC-11A)
	Pipe Conveyor Foundation
	0 Three (3) Position CCR Shuttle Conveyor (BC-12) 0A CCR Truck Loading Conveyors (BC-13A) 0B CCR Truck Loading Conveyors (BC-13B)
	0 CCR Emergency Stacking Conveyor (BC-13C)
	0 Bottom Ash Apron Belt Feeder (AF-8) 0 Bottom Ash Transfer Conveyor (BC-9) 0 Bottom Ash Crusher Belt Scale
	Pipe Conveyor and Termination End Electrical Equipment and associated Electrical Power/Control Feed (from CCRT Area to Termination End)
	Fiber and Telecommunications Termination End
	Lighting and Receptacles Termination End
	Grounding and Lightning Protection (from Bridge to Termination End)
	Electrical Manholes and Underground Electrical Ductbank Termination End
	Potable Water Piping and Sewage Holding Tank Termination End
	Loop Road Drainage
	Haul Road and Loop Road
	Bridge
	Leachate Pond Area: All Electrical/Control to PDC Equipment and Pumps, Electrical Power/Control from Termination End to Leachate Pond
	Leachate Pipe and Pump Station Pit (Underground)
	Low Pressure Service Water Pipe (Underground)

GENERATION PLANT	
Bottom Ash Subproject (new and removal)	
	Remove Unit 1 Combustion Engineering Boilers' Bottom Ash Hopper and Associated Equipment
	Study and Relocation of Boiler Structural Steel Support Beam
	Unit 1 Bottom Ash Bunker and Cover
	Unit 1 Local Submerged Chain Conveyor
	Unit 1 Secondary Drag Chain Conveyor
	Unit 1 Bottom Ash Crusher
	Unit 2 Ash and Pyrites Bunker Cover
Gypsum Subproject	
	Transfer Tower TT-4 Building
	Gypsum Dewatering Facility Building
	Gypsum Subproject Foundations (All)
	Gypsum Subproject Stair Towers, Ladders and Platforms
	Two Vacuum Belt Filters and related equipment (hydrocyclone, vacuum pumps skids, piping, etc.)
	0A Gypsum Shuttle Conveyor (BC-1A) 0B Gypsum Shuttle Conveyor (BC-1B) 0A Gypsum Elevating Belt Conveyor (BC-2A) 0B Gypsum Elevating Belt Conveyor (BC-2B) 0A Overhead Reversible Shuttle Conveyor (BC-3A) 0B Overhead Reversible Shuttle Conveyor (BC-3B)
	0 Dual Augers (DA-4)
	0 Reclaim Conveyor (BC-4) 0A Gypsum Transfer Conveyor (BC-5) 0B Gypsum Transfer Conveyor (BC-6) 0 Gypsum Shuttle Conveyor (BC-7)
	Gypsum Storage Enclosure (12,000 tons)
	0 Portal Scraper Reclaimer (PSR-1) Reclaim Hopper (RH-4)
	Hydrocyclone Feed Storage Tanks (2) 620,000 gallons working volume
	Gypsum Slurry Transfer Piping
	Reclaim Water Tanks (2) 100,000 gallons working volume
	Pipe Rack: Foundations, Steel, Pipe
Common (new and removal)	
	Maintenance/Shop Building CCRT Area
	Electrical/Control Building CCRT Area
	Electrical/Control Building Maintenance Elevator CCRT Area
	HVAC: Electrical/Control Building and Gypsum Dewatering Building

<i>GENERATION PLANT</i>	
	CCRT Area Electrical Equipment (transformers, switchgear, MCCs, Non-Segregated Bus Duct, cable, conduit, cable tray)
	UPS, DC Batteries / Charger, Emergency Eyewash for Battery Room
	Lighting and Receptacles CCRT Area
	DCS Control CCRT Equipment
	Fiber Cable / Racks Telephone Cable, Handsets, Racks, Public Address Equipment
	Grounding CCRT Area
	Lightning Protection CCRT Area
	Cathodic Protection System CCRT Area
	Remove (Ash Pond 14kv "A and B" power cables from Switching Station to new CCRT Electrical Bldg.)
	Air Compressor and Piping
	Sanitary Sewer Piping CCRT Area
	Plant site Road / Driveway CCRT Area
	Surface Excavation and Backfill CCRT Area
	Stormwater Manholes, Fire Protection, and Yard Drainage Pipe CCRT Area
	Electrical Manholes and Underground Electrical Ductbank CCRT Area

**EXHIBIT X
SUBMITTALS, REVIEWS, AND HOLD POINTS**

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1. SUBMITTALS

1.1 Summary

- A. This section includes definitions, descriptions, transmittal, and review of submittals.
- B. Related Work specified elsewhere:
 1. Project meetings, schedules, and reports: Refer to **Exhibit M** – Meetings, Coordination and Progress Reports of the Agreement.

1.2 General Information

- A. Definitions:
 1. Select shop drawings (meaning Equipment and fabrication requirements for construction, inclusive of arrangement, sub drawings, etc., provided inclusive of field requirements for Owner's use regarding future operations and maintenance), product data, and samples are technical submittals prepared by Contractor, Subcontractor, manufacturer, or other Person and submitted by Contractor to Owner as a basis for approval of the use of Equipment and materials proposed for incorporation in the Work or needed to describe installation, operation, maintenance, or technical properties, as specified in each division of the Technical Specifications.
 - a. Shop drawings include custom prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.
 - b. Product data includes standard printed information on materials, products, and systems; not custom prepared for this Work, other than the designation of selections from available choices.
 - c. Samples include both fabricated and un-fabricated physical examples of materials, products, and Work; both as complete units and as smaller portions of units of Work; either for limited visual inspection or where indicated for more detailed testing and analysis. Mockups are a special form of samples which are too large to be handled in the specified manner for transmittal of sample submittals.
 2. Informational submittals are those technical reports, administrative submittals, certificates and guarantees not defined as shop drawings, product data, or samples.
 - a. Technical reports include laboratory reports, tests, technical procedures, technical records, and Contractor's design analysis.
 - b. Administrative submittals are those nontechnical submittals required by the Agreement or deemed necessary for administrative records. These submittals include maintenance agreements, bonds, project photographs, physical Work records, statements of applicability, copies of industry standards, project record data, schedules, security/protection/safety data, and similar type submittals.
 - c. Certificates and guarantees are those submittals on Equipment and materials where a written certificate or guarantee from the

manufacturer or Contractor is called for in the Technical Specifications.

3. Refer to sections 1.3 and 1.4 of this document for detailed lists of submittals and specific requirements.

B. Quality Requirements:

1. Submittals such as drawings and data submitted shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings such as reproducible shall be useable for further reproduction to yield legible hard copy.
2. Documents submitted that do not conform to the specified requirements shall be subject to rejection by Owner, and upon request, Contractor shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's or its Subcontractors' failure to initially satisfy the legibility quality requirements will not relieve Contractor or its Subcontractors from meeting the required schedule for submittals.

C. Language and Dimensions:

1. All words and dimensional units shall be in the English language.
2. Metric dimensional unit equivalents may be stated in addition to English units. However, English units of measurement shall prevail.

D. Submittal Completeness:

1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Owner to review the information effectively.
2. Where standard drawings are furnished which cover a number of variations of the general class of Equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the Equipment being furnished. Use hatch marks to indicate variations which do not apply to the submittal. The use of "highlighting markers" will not be an acceptable means of annotating submittals. Such annotation shall also include proper identification of the submittal permanently attached to the drawing.
3. Reproduction or copies of Agreement drawings or portions thereof will not be accepted as complete fabrication or erection drawings, but will be acceptable when used by Contractor as a drawing upon which to indicate information on erection or to identify detail drawing references. Whenever the Agreement drawings are revised to show additional Contractor's information, the title block shall be replaced with Contractor's title block, and the professional seal shall be removed from the drawing.

E. Form of submittals:

1. Submittals and other project documents shall be transmitted in electronic format as specified.
 - a. Electronic format shall include Microsoft Office formats, Adobe *PDF format, Primavera, or AutoCAD.



- b. Selected submittals may be provided in paper ("hardcopy") copies with advance approval of Owner, and using procedures specified herein.
 - c. Equipment instruction books and operating manuals shall be provided in paper copies in addition to specified electronic format.
2. Electronic format using Owner's document management system (DMS) for final record submittals and Owners' Engineer document locator (DL) system for submittals issue for review and approval:
 - a. Scanned submittals and documents are not acceptable. Transmit submittal and project documents in:
 - (1) Adobe *PDF files created directly from native electronic format, or
 - (2) Owner approved equal.
 - (3) Electronic submittals in .TIF format are permitted only with specific Owner approval.
 - (4) Documents requiring review and comment shall be submitted in Adobe *PDF and native file formats.
 - b. Each drawing shall be submitted with an electronic file name that is equivalent to the drawing number, and any resubmitted drawing shall use the same file name as the original file name each time. No spaces or periods (except in the file extension) are allowed in the file name.
 - c. Contractor submittals shall be accompanied with a completed transmittal letter. Submittals that are not accompanied with an approved transmittal letter will not be accepted and will be returned to Contractor.
 - d. All Contractor transmittal letters submitted to Owner shall be in the form supplied and shall contain as a minimum the following information:
 - (1) Contractor's name
 - (2) Project number
 - (3) Agreement number
 - (4) Filename
 - (5) Description of the information contained in the specific submittal
 - (6) Revision number
 - (7) Submittal type
 - (8) Date of submittal
 - e. Nonconforming submittals are subject to rejection.
3. Owner's review comments will be provided electronically in both the native file format and Adobe *PDF format.
4. Digital delivery media for transmittal of electronic documents and submittals shall be through Owners' Engineer DL system project website in accordance with the procedures included in **Exhibit X Appendix B - Vendor Submittal Reference Document** (Burns & McDonnell), and

Owner's DMS in accordance with the procedures specified herein, as addressed below. See section 3.0 for more details.

1.3 Technical Submittals

- A. Items shall include but not be limited to, the following:
1. Manufacturer's specifications
 2. Catalogs, or parts thereof, of manufactured Equipment
 3. Shop fabrication and erection drawings
 4. General outline drawings of Equipment showing overall dimensions, location of major components, weights, and location of required building openings and floor plates.
 5. Detailed Equipment installation drawings, showing foundation details, anchor bolt sizes and locations, base plate sizes, location of Owner's connections, grounding pads and all clearances required for erection, operation, and disassembly for maintenance.
 6. Schematic diagrams for electrical items, showing external connections, terminal block numbers, internal wiring diagrams, and one-line diagrams.
 7. Bills of material and spare parts list
 8. Instruction books and operating manuals
 9. Material lists or schedules
 10. Concrete mix design information.
 11. Performance tests on Equipment by manufacturers
 12. Samples and color charts
 13. All drawings, catalogs, or parts thereof, manufacturer's specifications and data, samples, instructions, and other information specified or necessary:
 - a. To determine that Equipment and materials conform to the design concept and comply with intent of the Agreement.
 - b. For proper erection, installation, operation, and maintenance of Equipment and materials which will be reviewed for general content but not for basic details.
 - c. To determine what supports, anchorages, structural details, connections, and services are required for Equipment and materials, and effects on contiguous or related structures, Equipment and materials.
- B. Prepare and submit the following lists for review:
1. Equipment list
 2. Manual valve list
 3. Actuated / control valve list
 4. Line list
 5. Electric motor list
 6. Instrument list
 7. Terminal point/connection list

Lists shall include the data fields defined in examples to be provided by the Owner. Lists shall be in Microsoft Excel ® format and Contractor shall not modify the format or sequence without Owner approval. Lists shall be submitted for initial review and resubmitted as a final list. The electronic template files to be used will be provided by Owner to the Contractor after contract award.

C. Schedule of submittals:

1. Prepare a schedule for submission of all submittals specified or necessary for approval of the use of Equipment and materials proposed for incorporation in the Work or needed for proper installation, operation, or maintenance. Submit the schedule with the Work progress schedule. Schedule submission of all submittals to permit review, fabrication, and delivery in time so as to not cause delay in the Work of Owner or its Subcontractors or any other Person as described herein.
2. In establishing schedule for submittals, allow fifteen (15) Business Days in Owner's office for reviewing original submittals and ten (10) Business Days in Owner's office for reviewing re-submittals.
3. Submittals requiring revisions will be resubmitted within fifteen (15) Business Days after receipt of Owner's review notations.
4. The schedule shall indicate anticipated dates of original submission for each item and shall be based upon at least one resubmission of each item.
5. Schedule all submittals (shop drawings, product data, and samples), not listed in section 2 below, required prior to fabrication or manufacture for submission as necessary to meet Agreement delivery requirements.
6. Resubmit submittals the number of times required to be approved. However, any need for re-submittals in excess of the number set forth in the accepted schedule, will not be grounds for extension of the schedule, provided that the impact on schedule delays due to changes in previously approved material will be considered on a case by case basis.

D. Transmittal of submittals:

1. All submittals (shop drawings, product data, and samples) for Equipment and materials furnished by Contractor, Subcontractors, manufacturers, and other Persons shall be submitted to Owner through the Contractor.
 - a. Reports and letters shall be 8.5"x11" unless containing drawings requiring 11"x17" for legibility.
 - b. Shop drawings shall be D size and submitted in electronic form unless otherwise agreed by Owner during the Work.
2. Transmit all submittals to Owner as follows:
 - a. Mark each submittal by project and/or Subproject name and number, Agreement title and number, and applicable Technical Specification section and article numbers. Include in the letter of transmittal the drawing number and title, sheet number (if applicable), revision letter, and electronic file name (if applicable). Unidentifiable submittals will be returned for proper identification.
 - b. Check and approve submittals of Subcontractors, other Persons, and manufacturers prior to transmitting. Contractor's submission shall constitute a representation to Owner that Contractor approves submittals and has determined and verified all design criteria, quantities, dimensions, materials, catalog numbers, compliance with Codes and standards, and similar data, and Contractor assumes full

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- responsibility for doing so; and Contractor has coordinated each submittal with requirements of the Work and the Agreement.
- c. At the time of each submission, call to attention in the letter of transmittal any deviations from requirements of the Agreement.
 - d. Make all modifications noted or indicated and return the required number of revised submittals until approved. Direct specific attention in writing, or on revised submittals, to changes other than the modifications called for by comments on previous submittals. Previously approved submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the submittal and resubmit for review.
 - e. Following completion of the Work and prior to final payment, furnish record documents and approved samples and shop drawings necessary to indicate "as constructed" conditions, including field modifications, in the number of copies specified. Furnish additional copies for insertion in Equipment instruction books and operating manuals as required. All such copies shall be clearly marked "PROJECT RECORD."
 - f. Submit a final record copy of the master field drawing list which shall indicate the final revision status of each drawing on the list.
 - g. Accompany submittal with transmittal letter containing date, Agreement number and title, Contractor's name, address and telephone number, number and title of each record document and signature of Contractor's authorized representative.
3. Quantity Requirements:
- a. Except as otherwise specified, transmit all shop drawings in the following quantities for Owner's use. Additional copies shall also be provided to the Owner as required by the Owner:
 - (1) Initial submittal: Electronic - One copy to Owner
 - (2) Re-submittals: Electronic - One copy to Owner
 - (3) Submittal for final distribution: Electronic - One copy to Owner
 - (4) As-constructed documents:
 - (5) Electronic - One copy to Owner
 - (6) Paper - One copy to Owner
 - b. Transmit submittals of product data as follows:
 - (1) Initial submittal: electronic - one copy to Owner
 - (2) Re-submittals: electronic - one copy to Owner
 - (3) Submittal for final distribution: electronic - one copy to Owner
 - c. Transmit submittals of material samples, color charts, and similar items as follows:
 - (1) Initial submittal - one to Owner
 - (2) Re-submittal - one to Owner
 - (3) Upon approval, no sample(s) will be returned to Contractor.

- d. Transmit submittals of equipment instruction books and operating manuals as follows:
 - (1) Initial submittal: electronic - one copy to Owner
 - (2) Re-submittals: electronic - one copy to Owner
 - (3) Submittal for final distribution - six paper copies and one electronic copy to Owner.
 - e. When all submittals have been updated to "as-constructed" conditions, transmit to Owner in electronic format.
 - f. Owner may copy and use for internal operations and staff training purposes any and all document submittals required by this Agreement and approved for final distribution, whether or not such documents are copyrighted, at no additional cost to Owner.
4. Equipment erection drawings and other submittals required for installation of Equipment furnished by others under separate contract for installation under this Agreement will be transmitted to Contractor by Owner in the final distribution of such submittals.
 5. Information to Manufacturer's District Office: Contractor shall arrange for manufacturers and suppliers of Equipment and materials to furnish copies of all agreements, drawings, specifications, operating instructions, correspondence, and other matters associated with this Agreement to the manufacturer's district office servicing Owner. Insofar as practicable, all business matters relative to Equipment and materials included in this Agreement shall be conducted through such local district offices.
- E. Owner's Review:
1. Owner may review submittals for indications of Work or material deficiencies.
 2. Owner will respond to the Contractor on submittals which indicate there may be a Work or material deficiency.
 3. Contractor shall respond promptly to Owner's comments.
 4. Owner's review of shop drawings, product data, or samples will not relieve Contractor of responsibility for any deviation from requirements of the Agreement unless Contractor has in writing calling Owner's attention to such deviation at the time of submission, and Owner has given written concurrence in and approval of the specific deviation. Approval by Owner shall not relieve Contractor from responsibility for errors or omissions in submittals.
- F. Instruction Books and Operating Manuals:
1. Refer to **Exhibit V** of the Agreement - Operating and Maintenance Manual Requirements for details.
- G. Samples:
1. Office samples shall be of sufficient size and quantity to clearly illustrate the following:
 - a. Functional characteristics of the product, with integrally related parts and attachment devices.
 - b. Full range of color, texture, and pattern.

- c. Material, manufacturer, pertinent catalog number, and intended use.

1.4 Informational Submittals

- A. Informational submittals are comprised of technical reports, administrative submittals, and guarantees which relate to the Work, but do not require Owner approval prior to proceeding with the Work. Informational submittals include but are not limited to:
1. Test reports
 2. Welder qualification tests.
 3. Welding procedure qualification tests.
 4. X-ray and radiographic reports.
 5. Hydrostatic testing of pipes.
 6. Field test reports.
 7. Concrete cylinder test reports.
 8. ASME pressure vessel test reports.
 9. Certification on materials:
 - a. Roofing laboratory tests.
 - b. Brick and concrete masonry unit laboratory tests.
 - c. Paint laboratory tests.
 - d. Metal paneling laboratory tests.
 - e. Cement tests.
 10. Soil test reports.
 11. Air handling balancing reports.
 12. Temperature records.
 13. Piping stress analysis.
 14. Progress photographs.
 15. Steel mill tests
 16. Shipping and/or packing lists
 17. Job progress schedules
 18. Equipment and material delivery schedules
 19. Warranties and guarantees
 20. Calculations
 21. Electrical System Models (e.g. SKM Power*Tools model)
 22. Physical Design Models (e.g. Intergraph's PDS)
- B. Transmittal of informational submittals:
1. All informational submittals furnished by Contractor, Subcontractors, manufacturers, and other Persons shall be submitted to Owner unless otherwise specified.
 - a. Identify each informational submittal by project name and number, Agreement title and number, and the Technical Specification section and article numbers marked thereon or in the letter of transmittal. Unidentifiable submittals will be returned for proper identification.

- b. At the time of each submission, call to the attention of Owner in the letter of transmittal any deviations from the requirements of the Agreement.
- 2. Quantity Requirements:
 - a. Technical reports and administrative submittals except as otherwise specified:
 - (1) Electronic: one to Owner.
- 3. Test Reports:
 - a. The party specified responsible for testing or inspection shall in each case, unless otherwise specified, arrange for the testing laboratory or reporting agency to distribute test reports as follows:
 - (1) Owner: one copy
 - (2) Contractor: one copy
- C. Owner’s Review:
 - 1. Owner may review informational submittals for indications of Work or material deficiencies.
 - 2. Owner will respond to the Contractor on those informational submittals which indicate Work or material deficiency.
 - 3. Contractors shall respond promptly within ten (10) Business Days to any identified deficiencies.

2. SUBMITTAL SCHEDULE & TECHNICAL DOCS

2.1 Submittal Schedule

Refer to **Exhibit X Appendix A** – Submittal Schedule

3. SPECIFICATION FOR ELECTRONIC SUBMITTAL OF CONTRACTOR DOCUMENTATION

3.1 Introduction

- A. The purpose of this document is to set forth the minimum standards for submittal of Contractor documentation for Equipment or package system purchases.
- B. Owner will utilize Owners' Engineer document locator system as the repository for preliminary submittals for review and approval. Owner will utilize Oracle IPM as a repository for final record drawings and conformance to construction records submittals. Both repository systems will provide secure storage, backup and recovery for all electronic files, document images, and various record types that are not likely to change. Examples: Contractor drawings, instruction manuals, correspondence and all other Contractor documentation. Drawing and document numbers are assigned by the Contractor.
- C. Documents from Subcontractors shall be included and provided in a similar fashion to those of the Contractor.
- D. Project records are to be submitted to Owner’s project manager per the specifications in **Exhibit X, Appendices C, D, E, and F** shall include a formal transmittal.

- E. Final documentation shall include the most recent revisions and up to date information, as-built or as-delivered modifications to be submitted thirty (30) days prior to Guaranteed Final Completion.
- F. In addition to these specifications, Contractor shall comply with the submittal specifications set forth in:
1. **Exhibit X, Appendix C** (LKE_CT_03.14) - Specifications for Electronic Submittal of Cable Tabulation Records
 2. **Exhibit X, Appendix D** (LKE_DMS_03.14) - Specifications for Electronic Submittal of Engineering Drawings
 3. **Exhibit X, Appendix E** (LKE_TL_03.14) - Specifications for Electronic Submittal of Vendor Documentation
 4. **Exhibit X, Appendix F** - Trimble County Component Numbering
- 3.2 Document Locator - Contractor Drawings/Other Documents for Submittal Review and Approval**
- A. This section provides minimum requirements on how preliminary documents for review and approval shall be provided electronically to Owner.
- B. Unless otherwise specified in this Agreement, preliminary documentation, drawings, specifications, and manuals are to be submitted in electronic format. Documents shall be separated into document types for electronic submittal.
- C. In addition, electronic submissions may be requested via e-mail, and hard copies may be required.
- D. Letter/Legal size documents are to be submitted in Microsoft Word or Adobe *PDF format.
- E. Drawings created by CAD software shall be submitted in AutoCAD DWG format or *PDF images. Non-CAD drawings shall be submitted in TIFF or *PDF formats.
- F. Each drawing submitted in CAD, *PDF, and TIFF format shall have a unique filename unless the drawing is only intended to be submitted as a page in a larger document or manual.
- G. Photographs, aerial photos or maps etc. shall be submitted in JPG format.
- H. If the number of records being submitted exceeds 20 records, an index (as it applies per type of record being submitted) shall be provided for each Contractor or Subcontractor drawing and other documentation for storage into document locator. Drawings are to be indexed individually. Other documentation, such as project files, can be batched by the document type and indexed as a group. The index shall be submitted electronically in Excel or Access format which includes, as a minimum, the information contained in Table 1 at the end of this section.
- 3.3 Oracle IPM (formerly Stellent IBPM) – Contractor Drawings/Other Documents for Final Records Submittals**
- A. This section provides minimum requirements on how final drawings and conforming to construction records documents shall be provided electronically to Owner.
- B. Unless otherwise specified in this Agreement, final documentation, drawings, specifications, and manuals are to be submitted in electronic format on CD or

- DVD. Documents shall be separated into document types before compiling onto CD or DVD for electronic submittal.
- C. In addition, electronic submissions may be requested via e-mail, and hard copies may be required.
 - D. Letter/Legal size documents are to be submitted in Microsoft Word or Adobe *PDF format.
 - E. Drawings created by CAD software shall be submitted in AutoCAD DWG format or *PDF images. Non-CAD drawings shall be submitted in TIFF or *PDF formats.
 - F. Each drawing submitted in CAD, *PDF, and TIFF format shall have a unique filename unless the drawing is only intended to be submitted as a page in a larger document or manual.
 - G. Photographs, aerial photos or maps etc. shall be submitted in JPG format.
 - H. If the number of records being submitted exceeds 20 records, an index (as it applies per type of record being submitted) shall be provided for each Contractor or Subcontractor drawing and other documentation for storage into Oracle IPM. Drawings are to be indexed individually. Other documentation, such as project files, can be batched by the document type and indexed as a group. The index shall be submitted electronically in Excel or Access format which includes, as a minimum, the information contained in Table 1 at the end of this section.
 - I. Oracle IPM - Technical Library Manuals and Reports
 - J. Technical manuals, parts catalogs and Equipment specifications originating from an Equipment manufacturer or distributor shall be submitted in *PDF format.
 - K. Power Plant system manuals which contain a compilation of customized technical specs or Equipment manuals from various sources must be provided in a sectional format with a detailed table of contents. System manuals may be submitted in a bound hardcopy or *PDF format. Hard copies shall be submitted with duplicate *PDF files. The *PDF shall closely mimic the sectional hardcopy style with a table of contents referencing each section. If the entire manual is greater than 200 pages, then each section must be provided as a separate *PDF file.
 - L. Technical and regulatory reports including outage reports must be submitted in *PDF format, rendered from the original document when possible, otherwise PDF's containing scanned images of the report(s) are acceptable.
 - M. All manuals and reports will be provided to Owner by filling out spreadsheets provided by Owner following the format laid out in Table 2 at the end of this section.
 - N. *PDF Format: All PDF documents submitted must be PDF/A-1a or PDF/A-1b compliant. See ISO Spec 19005-1:2005 Document Management - electronic document file format for long term preservation - Part 1 Reference: <http://en.wikipedia.org/wiki/PDF/A>

TABLE 1 – Typical Information for Oracle IPM Data Submission

Field Name	Character Limit	Examples
Document ID#	20	Agreement #, PO #, Spec ID #, Photo # or Plant ID #
Initiative #	16	LG&E Project #
Contractor	40	Manufacturer
Contractor Document ID	30	Manufacturing Drawing #
AE Name	40	
AE Drawing #	30	
Type of Equipment Description	90	Drawing or Record Title, Description
Plant/Location	20	
Unit	20	TC1 or COM for common systems
Comments	50	Additional information pertaining to document
Record Type	10	Record Types: PD – for Drawings and PF – for other documentation. If PF applies then Document Type must also be supplied. Files are to be batched and labeled by Document Type.
Record Source	20	Contractor
Document Type	20	Contracts, specifications, financial, proposal/bids, correspondence, manuals, pictures and miscellaneous.
Record Description	50	Specific type of record for example : Structural Calculations Report
Volume #	10	With leading 0's (001, 010 or 999)
System	50	
Equipment #	50	EID #, Serial #, Shop Order #
Date	10	MM/DD/YYYY (Format consistency important)

TABLE 2 – Typical information for Technical Library Manuals and Reports

Data Entry Instructions			
Field Name	Description / Comments	Type / Length	Values / Examples
Media Label	The name of the media the document is contained on. Please make sure to uniquely identify each media volume delivered, use black permanent marker to label media.	Char / 20	Project Name – IOM-001
File Path	Enter the relative path of the file being indexed without drive a letter. (Path relative to the root of the source media, CD/DVD, etc.)	Char / 50	\\dir1\dir2\filename.pdf
Record Type	Manual for all IOM Manuals, sections or chapters contained in a manual. Report for all inspection or reports on specific plant Equipment and or systems that are not specifically incorporated with an IOM Manual.	Picklist	MANUAL, REPORT
Document Id	Order #, PO #, Agreement #, Spec Id	Char / 20	Agreement #, PO #
Project No	LG&E designated project number	Char / 16	LG&E Project Number
Plant	Standard 2 Character Plant ID	Picklist	TC
Unit	Standard 2 digit Unit Id, 00 designates entire plant facility	Picklist	00, 01, 02, 03, etc.
System	System name from Maximo	Picklist	FUEL OIL EQUIPMENT, COAL CONVEYOR
Sub-System	Sub-system name from Maximo	Picklist	ALARM MISC INST. AND CONTROL
Manual / Report Title	Manual / Report Title is repeated for each section / chapter for all entries contained in a particular manual or report. Including tables of contents, sections/chapters appendixes and attachments	Char / 50	COAL CONVEYOR

Data Entry Instructions			
Field Name	Description / Comments	Type / Length	Values / Examples
Volume	Volume Id of Manual or Report	Numeric / 3	1, 2, 3 etc.
Set (Volume Set)	Volume set Id of Manual or Report	Numeric / 3	1, 2, 3 etc.
Manufacturer / Contractor	Name of manufacturer or Contractor of Equipment	Char / 30	General Electric
Revision Date	Document revision date	Char / 10	MM/DD/YYYY or MM/YYYY
Section / Chapter ID	Please use the following conventions for section enumeration: TOC Table of Contents, 00 Entire Manual or Report contained in a single file. Letters and/or numbers can be used. Examples: (1 = Section 1), (1.1 = Section 1 Sub-section 1), (1.1.1, 1.1.a and 1.1.1a) are all valid. Make sure that all ID's are in the proper sequential order for each Manual or Report.	Char / 10	Sequential enumeration of Section / Chapter
Section / Chapter Description	Detailed description of Section or Chapter	Char / 150	Section / Chapter level description
Comments	Data entry comments (not filed)	Char / 150	Misc. comments

4. HOLD POINTS

4.1 Introduction

- A. The utilization of documented inspect and Hold Points as quality assurance inspection tools are integral to the construction process, to which the Owner retains the right to maintain surveillance of consisting of but not limited to the following; construction activity, element of Work, trade work or providing a product section. The task can be located either at the site or another location including but not limited to manufacturer, vendor or Subcontractor facilities.
1. Contractor will implement their own inspection and test plan, quality control.
 2. Owner may provide a third party inspection company that furnishes inspectors as needed, sometimes full time, and other times, only as needed. Testing company inspectors will be utilized to witness and sign off on Hold Points.
 3. Many items, activities, functions, testing and inspections will occur during the normal course of a day's work and test results for inspections will be documented, therefore witness or Hold Points should be reserved for construction work that requires an inspection and would become inaccessible due to subsequent activities.

4. Actual “Hold” points should be specified sparingly, since each Hold Point can potentially introduce a delay. Delays may be in terms of hours but could result in a claim.
- B. A list of inspection points includes but is not limited to the following; (Witness or Hold Points, as desired):
1. Hold the release of all issued for construction drawings for approval of the Equipment Accessibility Plan.
 2. Hold for approval of critical lift plans is a Hold Point during erection.
 3. Hold; inspection required for weld prep, root pass of critical welds (if applicable to this Work).
 4. Hold for inspection; verify alignment of pipe to Equipment prior to connection. All alignments to be performed with laser equipment and must have current calibrations.
 5. Hold for inspection of subgrade prior to placement of structural fill, concrete forms etc.
 6. Hold; inspect concrete forms, rebar and embedment, including grounding and conduit, prior to concrete placement. This requires a pre-placement form.
 7. Hold for verification of concrete strength for foundations prior to setting structural steel. This requires a certification form.
 8. Hold; inspection of steel surface preparation prior to paint.
 9. Hold; inspection of grout pockets required prior to placement of baseplates or columns with attached plates.
 10. Hold for Owner acceptance Flow Model Review.
 11. Hold; testing company technician to be present during backfill placement and compaction testing.
 12. Hold; verify dry film thickness of paint primer, then final coat.
 13. Hold; third party inspector to be on site and present during bearing pile installation to verify location, inspect pile prior to installation, and document blow counts. Test instrumentation for micropiles tension, compression and side load tests must be verified as having current calibration. All ground connections must be verified as having solid connections to the plant ground system.
 14. Hold; prior to final acceptance and approval of structural steel connection final bolt up, third party inspector must document and accept the installation.
 15. Hold; for inspection of electrical devices (transformers, switchgear, MCC, controls) prior to energization.
 16. Include any holds required specifically by Major Subcontractors or suppliers.
 17. Hold; inspection and witness the testing of grounds prior to acceptance.
 18. Hold; Bridge Abutment No. 1 area is subject to a hold period of a minimum of three months to allow the alluvial soils to compress following the construction of the embankment and prior to driving production piles for the bridge. The Contractor’s Registered Surveyor will measure and record

settlement to the nearest 0.01 foot, and elevation of the embankment at weekly intervals or more frequently in order that no more than 10 percent of the expected settlement occurs between readings. The Contractor will furnish these results immediately to the Owner. Continue to measure and record rate of settlements until rate reduces to less than ½ inch per month.

C. Any of the above items can be designated as a “Witness Point”.

5. REQUIRED SUBMITTALS

Contractor shall provide the below listed submittals and any additional submittals identified in Exhibit A.

➤ 014000 – Contractor QA/QC

1. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
2. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - a. Technical Specification section number and title.
 - b. Description of test and inspection.
 - c. Identification of applicable standards.
 - d. Identification of test and inspection methods.
 - e. Number of tests and inspections required.
 - f. Time schedule or time span for tests and inspections.
 - g. Entity responsible for performing tests and inspections.
 - h. Requirements for obtaining samples.
 - i. Unique characteristics of each quality control service.
3. Reports: Arrange for testing agency/laboratory to prepare and submit certified written reports that include the following:
 - a. Date of issue.
 - b. Project title and number.
 - c. Name, address, and telephone number of testing agency.
 - d. Dates and locations of samples and tests or inspections.
 - e. Names of individuals making tests and inspections.
 - f. Description of the Work and test and inspection method.
 - g. Identification of product and Technical Specification section.
 - h. Complete test or inspection data.
 - i. Test and inspection results and an interpretation of test results.
 - j. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - k. Comments or professional opinion on whether tested or inspected Work complies with the Agreement document requirements.
 - l. Name and signature of laboratory inspector.
 - m. Recommendations on retesting and re-inspecting.

4. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- **018213 – Foundation Design Criteria**
1. Calculations:
 - a. Submit as specified in **Exhibit A** and Part 1, paragraph 1.05A – Design Calculations, of section 018213.
- **023213 – Subsurface Investigation**
1. Qualifications:
 - a. Prior to conducting subsurface investigation, submit for review, comment and approval by Owner the name and qualification statement for proposed geotechnical engineer.
 2. Scope of Work:
 - a. Prior to conducting subsurface investigation, submit for review, comment and approval by Owner the proposed scope of subsurface investigation, including number, location and depths of borings, anticipated plan for laboratory testing, and detailed descriptions of additional testing including electrical resistivity, cross-hole seismic or other required testing.
 3. Reports:
 - a. Submit the following reports for review and comment by Owner:
 1. Draft geotechnical report.
 2. Final geotechnical report.
- **024100 - Demolition**
1. Submit proposed methods and operations of demolition for review prior to the start of Work. Include in the schedule the coordination for shutoff, capping, and continuation of utility services as required, together with details for dust, noise, and erosion control protection.
 2. Provide a detailed sequence of demolition and removal Work to ensure the uninterrupted progress of Owner's operations.
- **026625 - HDPE Pipe**
1. Submittals required shall include the following:
 - a. Pipe and jointing details.
 - b. Special, fitting, and coupling details.
 2. Certificates and Affidavits:
 - a. Prior to shipment, furnish affidavit of compliance with applicable standards.
 - b. Provide documentation of field testing including date, time, witnesses, and test results.
 - c. Contractor shall certify that personnel to perform fusion joining have received factory training.

Handwritten signature and initials in blue ink, possibly reading 'Jm' and 'AAR'.

- **032000 – Concrete Reinforcement**
 1. Submittals required shall include, but not limited to, the following:
 - a. Complete bar schedule, bar details, and erection drawings to conform to ACI SP-66.
 - b. Drawing with each type of bent bar marked with identification mark. Straight bars shall have mark number or be identified by size and length.
 - c. Erection drawings shall be clear, easily legible, and to a minimum scale of:
 - (1) 1/4 inch = 1 foot (1:50).
 - (2) 1/8 inch = 1 foot (1:100) if bars in each face are shown in separate views.
 - d. Size and location of all openings.
 - e. Concrete protective cover.
 - f. Grade of steel.
 - g. Lap splice lengths.

- **033000 - Concrete**
 1. Submittals required shall include, but not limited to, the following:
 - a. Nonshrink grouts.
 - b. Admixtures.
 - c. Bonding agents.
 - d. Curing agents.
 - e. Concrete floor hardeners, sealers, and coloring compounds.
 - f. Expansion joint materials.
 - g. Joint sealants.
 - h. Waterstops.
 2. Mill Certificates:
 - a. Submit to Owner a minimum of one copy for each cement shipment.
 3. Concrete Mix Design Proportions:
 - a. Submit as specified in Part 2, paragraph 2.01D - Mix Proportions, of section 033000.
 - b. Submit for each mix design, including aggregate gradation data.
 - c. Resubmit for any change in each mix design.
 4. Production Test Reports: Submit as specified in **Exhibit M** and Part 2, paragraph 2.01E - Measurement of Materials, of section 033000.

- **051200 - Steel**
 1. Submittals required shall include, but not limited to, the following:
 - a. Fabrication and erection drawings for all Work. A reproduction of engineer-prepared contract drawings may be used for erection drawings such as to indicate information on erection or to identify detail drawing references. Where the drawings are revised to show this additional information, engineer's title block and professional seal shall be removed from the drawing. These erection drawings shall be revised for subsequent Owner revisions to the contract drawings.



- b. Fabrication and erection drawings shall be grouped in sets or sequences and shall be identified separately for each building, structure, or area.
 - c. Fabrication and erection drawings shall be prepared using a three dimensional steel modeling and detailing software system. All miscellaneous steel items such as guardrail, handrail, stairs, and ladders shall be included in the same three dimensional model as main structural steel and detailed using the same system.
 - d. In the event that drawing revisions are necessary, fabrication and erection drawings shall be clearly clouded showing all changes from the previous revision.
 - e. All necessary information for the fabrication, including connection material specifications and sizes as well as filler metal for welds, of the component part of the structure, presented on drawings to conform to recognized standard practice, AISC Manual and AWS Code.
 - f. Drawings indicating stud shear connector spacing regardless of whether connectors are shop-applied or field-applied.
 - g. Drawings showing each piece including anchor bolts marked for identification to correspond to erection drawings.
 - h. Proposed method and location for erection piece mark numbering.
 - i. Manufacturer's literature on products including, but not limited to, grating, stair treads, stair nosing, stud shear connectors, grout, concrete anchors, and protective coatings.
 - j. AWS Certified Welding Inspector Certificates.
 - k. Welder qualification records.
 - l. Qualified welding procedure specifications and procedure qualification test results if welding processes differ from those prequalified by AWS.
 - m. Designation of the members and connections that are part of the Seismic Load Resisting System (as marked on contract drawings).
 - n. Locations of demand critical shop and field welds.
 - o. Locations and dimensions of protected zones.
 - p. Gusset plates drawn to scale when they are detailed to accommodate inelastic rotation.
 - q. Drawings showing access hole dimensions, surface profile, and finish requirements.
 - r. Locations where backing bars are to be removed.
 - s. Locations where supplemental fillets are required when backing is permitted to remain.
 - t. Locations where weld tabs are to be removed.
 - u. Those joints or groups of joints in which a specific assembly order, welding sequence, welding technique or other special precautions are required.
 - v. Non-destructive testing to be performed by the fabricator/erector, if any.
2. Mill Tests:
 - a. Perform for each melt of material used in the fabrication.
 - b. Furnish two copies of each certified mill test to Owner.
 3. High-Strength Connection Bolt and Nut Manufacturer's Inspections Certificate:

- a. Certify that bolts, nuts, and washers furnished comply with all of the requirements of these Technical Specifications, and shall provide complete manufacturer's mill test reports (Manufacturer's Inspections Certificate).
- b. Certificate numbers shall appear on the product containers and correspond to the identification numbers on the mill test reports.
- c. Manufacturer's symbol and grade markings shall appear on all bolts and nuts.

➤ **05500 – Metal Fabrications**

1. Submittal required shall include, but no limited to, the following:
 - a. Fabrication and erection drawings for all Work including anchor bolts and welds.
 - b. Shop drawings and engineering design calculations for all components of stairs and landings with design live loads noted, and drawings sealed by professional engineer licensed in the Commonwealth of Kentucky.

➤ **07200 – Building Insulation**

1. Submittal required shall include, but no limited to, the following:
 - a. Product data for each type of product indicated.
 - b. Samples for Verification: Full-size units for each type of exposed insulation indicated.

➤ **074113 – Metal Roof Panels**

1. Submittal required shall include, but no limited to, the following:
 - a. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal roof panel and accessory.
 - b. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled Work.
 - (1) Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - (a) Flashing and trim.
 - (b) Gutters.
 - (c) Downspouts.
 - (d) Roof curbs.
 - (e) Snow guards.
 - (2) For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - c. Coordination Drawings: Roof plans drawn to scale and coordinating penetrations and roof-mounted items. Show the following:
 - (1) Roof panels and attachments.
 - (2) Purlins and rafters.

- (3) Roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, snow guards, and items mounted on roof curbs.
- d. Samples for Initial Selection: For each type of metal roof panel indicated with factory-applied color finishes.
 - (1) Include similar samples of trim and accessories involving color selection.
- e. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below.
 - (1) Metal Roof and Soffit Panels: 12 inches long by actual panel width. Include fasteners, clips, battens, closures, and other metal roof panel accessories.
 - (2) Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
 - (3) Vapor Retarders: 6-inch- square samples.
 - (4) Accessories: 12-inch- long samples for each type of accessory.
- f. Qualification Data: For installer.
- g. Material Certificates: For thermal insulation, signed by manufacturers.
- h. Field quality-control inspection reports.
- i. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 - (1) Metal Roof and Soffit Panels: Include reports for air infiltration, water penetration, thermal performance, fire-test-response characteristics, solar reflectance, and structural performance.
 - (2) Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
- j. Maintenance Data: For metal roof panels to include in maintenance manuals.

➤ **074213 – Metal Wall Panels**

- 1. Submittal required shall include, but no limited to, the following:
 - a. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal wall panel and accessory.
 - b. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment systems, trim, flashings, closures, and accessories; and special details. Distinguish between factory- and field-assembled Work.
 - (1) Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
 - (a) Flashing and trim.
 - (b) Downspouts.

- (2) For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- c. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items. Show the following:
 - (1) Wall panels and attachments.
 - (2) Girts.
 - (3) Wall-mounted items including doors, windows, louvers, and lighting fixtures.
- d. Samples for Initial Selection: For each type of metal wall panel indicated with factory-applied color finishes.
 - (1) Include similar samples of trim and accessories involving color selection.
 - (2) Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.
- e. Samples for Verification: For each type of exposed finish required, prepared on samples of size indicated below.
 - (1) Metal Wall Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal wall panel accessories.
 - (2) Include four-way joint for composite panels.
 - (3) Translucent Panels: 12 inches long by actual panel width.
 - (4) Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
 - (5) Vapor Retarders: 6-inch- square samples.
 - (6) Accessories: 12-inch- long Samples for each type of accessory.
 - (7) Exposed Gaskets: 12 inches long.
 - (8) Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of metal wall panels adjacent to joint sealants.
- f. Qualification Data: For installer.
- g. Material Certificates: For thermal insulation, signed by manufacturers.
- h. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:
 - (1) Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
 - (2) Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- i. Field quality-control test reports.
- j. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:
 - (1) Metal Wall Panels: Include reports for air infiltration, water penetration, thermal performance, fire-test-response characteristics, and structural performance.



- (2) Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
 - k. Research/Evaluation Reports: For metal-faced composite wall panels.
 - l. Maintenance Data: For metal wall panels to include in maintenance manuals.
- **076200 – Sheet Metal Flashing and Trim**
- 1. Submittal required shall include, but no limited to, the following:
 - a. Product data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.
 - b. Shop drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.
 - c. Samples of sheet metal flashing, trim, and accessory items, in the specified finish. Where finish involves normal color and texture variations, include sample sets composed of 2 or more units showing the full range of variations expected.
 - (1) 8-inch- square samples of specified sheet materials to be exposed as finished surfaces.
 - (2) 12-inch- long samples of factory-fabricated products exposed as finished Work. Provide complete with specified factory finish.
- **079200 – Joint Sealants**
- 1. Includes, but not limited to, the following for each type of sealant or associated material required:
 - a. Product data and Technical Specifications, including instructions for joint preparation and sealer application.
 - b. Color charts.
 - c. Samples for Initial Selection Purposes: Submit samples consisting of strips of actual product showing full range of colors available for each type of sealant exposed to view.
 - 2. Certificates: Review the joint design and Technical Specifications and verify that the joint system is appropriate for its location and that sealant materials comply with Technical Specifications.
- **083323 – Overhead Coiling Doors**
- 1. Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - a. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 - b. Summary of forces and loads on walls and jambs.

- c. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
 - d. Fire-Rated Doors: Information describing fire-release system, including testing and resetting instructions.
 2. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
 - a. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.
 3. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.
 4. Samples for Verification: Of each type of exposed finish required, prepared on samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.
 - a. Curtain slats: 12-inch (300-mm) length.
 - b. Bottom bar: 6-inch (150-mm) length.
 - c. Guides: 6-inch (150-mm) length.
 - d. Brackets: 6-inches (150-mm) square.
 - e. Hood: 6-inches (150-mm) square.
 5. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- **099000 – Protective Coatings**
 1. Schedule of products and paint systems to be used. Schedule shall include the following information:
 - a. Surfaces for system to be applied.
 - b. Surface preparation method and degree of cleanliness.
 - c. Product manufacturer, name, and number.
 - d. Method of application.
 - e. Dry film mil thickness per coat of coating to be applied.
 2. Color charts for selection and acceptance.
 3. Technical and material safety data sheets.
- **133419 – Metal Building Systems**
 1. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of the following metal building system components:
 - a. Structural-framing system.
 - b. Roof panels.
 - c. Wall panels and liners.
 - d. Insulation.
 - e. Vapor retarders.
 - f. Trim and closures.

- a. Roof Panels: 12 inches (300 mm) long by actual panel width. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
 - b. Wall Panels: 12 inches (300 mm) long by actual panel width. Include clips, caps, battens, fasteners, closures, and other exposed panel accessories.
 - c. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
 - d. Vapor Retarders: 6-inch- (150-mm-) square samples.
 - e. Accessories: 12-inch- (300-mm-) long samples for each type of accessory.
5. Product Certificates: Signed by manufacturers of metal building systems certifying that products furnished comply with requirements.
- a. Advance Letter of Design Certification: Within 4 weeks of Owner authorization to proceed, provide the same information as described below for Letter of Design Certification indicating intended compliance. The Advance Letter of Design Certification will be signed and sealed by the qualified professional engineer under whose immediate personal supervision the design will be performed.
 - b. Letter of Design Certification: Signed and sealed by a qualified professional engineer under whose immediate personal supervision the design was performed. Include the following:
 - (1) Name and location of project.
 - (2) Order number.
 - (3) Name of manufacturer.
 - (4) Name of Contractor.
 - (5) Building dimensions, including width, length, height, and roof slope.
 - (6) Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - (7) Governing building code and year of edition [as required by Agreement documents].
 - (a) Building-Use Category: Indicate category of building use and its effect on load importance factors.
 - (b) Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design criteria, and auxiliary loads (cranes).
 - (c) Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - (d) IAS Certification under AC472: Include statement that the metal building system and components were designed and manufactured under procedures and facilities certified by IAS.
 - (8) Provide a specific list of exceptions to the Agreement documents taken by the metal building systems manufacturer in the design and manufacture of the building and components supplied.
 - c. Welding Certificates: Copies of certificates for welding procedures and personnel.

- d. Erector Certificates: Signed by manufacturer certifying that erectors comply with requirements.
- e. Manufacturer Certificates: Signed by manufacturers certifying that they comply with requirements. Include evidence of manufacturing experience.
- f. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- g. Material Test Reports: From a qualified testing agency indicating and interpreting test results of steel for compliance with requirements indicated.
- h. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:
 - (1) Thermal insulation.
 - (2) Vapor retarders.
- i. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating the following current products comply with requirements:
 - (1) Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.
- j. Warranties: Special warranties specified in this section.

➤ **133423 – Power Control Module**

1. Includes, but not limited to, the following:
 - a. Design criteria.
 - b. Quality plans, forms, and procedures applicable to the manufacture of the building.
 - c. Drawing legend.
 - d. Bill of material including quantity, description, and part number.
 - e. Outline - Plan view (general arrangement, internal Equipment layout, center of gravity, weights, floor opening sizes and locations, recommended pier and tie down locations, location of platforms and stairs, mounting details, cable entry area, and door swing requirements).
 - f. Outline - elevation view (general arrangement in elevation, recommended pier and tie down locations, wall opening sizes and locations, location of platforms and stairs).
 - g. Foundation loads, anchorage requirements and details.
 - h. Enclosure services electrical diagram.
 - i. HVAC Equipment sizing calculation.
 - j. A structural analysis report including wind and snow loads prepared and stamped by a registered professional engineer.
 - k. Schematic and wiring diagrams of the complete electrical systems.
 - l. Electrical schematic diagrams indicating cable numbers and wire terminal points for all interconnecting PCM cable. Schematics shall also show all alarm contacts and signals from PCM Equipment to the DCS or multiplexer.
 - m. Panelboard schedules.

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- n. Structural fabrication detail drawings.
 - o. Lifting plan and details.
 - p. Photos of enclosure lifting at the factory.
 - q. A list of all items removed for shipment that will need to be installed by others.
 - r. Certified test reports.
 - s. Discrepancies list as specified.
 - t. Paint plan.
 - u. Paint samples.
 - v. 3-D Model of PCM and Equipment mounted in the PCM.
- **260500 – Cable Bus Equipment and Installation**
- 1. Includes, but not limited to, the following:
 - a. Arrangement and outline drawings.
 - b. Installation drawings.
 - c. Bills of material.
 - d. Isometric diagrams.
 - e. Instruction books.
 - f. Weight per linear foot of assembled cable bus.
 - g. Calculated cable pulling tension.
 - h. Conductor temperature rise calculations.
 - i. Current balance calculations.
 - j. Shield voltage calculations
 - k. Voltage drop data and calculations.
 - l. Submit a cable pull plan, drawings, calculations and job hazard analysis for approval by the Owner prior to installation.
- **260504 - Wire, Cable, and Accessories**
- 1. Data sheets for each wire and cable type specified.
 - 2. Data sheets for wire and cable accessories.
 - 3. Cable manufacturer's approval of splicing and terminating materials.
 - 4. Cable manufacturer's approval of pulling compounds.
 - 5. Cable manufacturer's installation requirements such as maximum pulling tensions, sidewall pressures, minimum bending radii, etc.
 - 6. Other Equipment and materials to be used.
 - 7. Un-priced wire and cable purchase orders.
 - 8. Two 1-foot samples of fiber-optic cable.
 - 9. Factory test results of each fiber-optic cable reel provided.
- **260506 - Specials**
- 1. Includes, but not limited to, the following:
 - a. Power and control schematic diagrams.
 - b. General arrangement and outline information.
 - c. Bills of material.
 - d. Instruction books.
 - e. Technical Specifications for all components.

- f. Mounting details for all components.
- g. Control panels - provide schematic and point-to-point wiring diagrams.
- 2. For "Fire Stops" and Fire Resistive Coatings:
 - a. Product data, specifications, and installation instructions. Include product characteristics, performance, and limiting criteria and UL listings.
 - b. Samples of each type of fire stop / smoke seal product and accessory specified or required to meet system requirements.

➤ **260507 - Pipe Freeze Protection System**

- 1. Includes, but not limited to, the following:
 - a. Piping line lists and isometrics including, but not limited to the following:
 - (1) Heating cable length.
 - (2) Heating cable type.
 - (3) Circuit number/heater number.
 - (4) Insulation information.
 - (5) Minimum maintenance temperature.
 - (6) Minimum ambient temperature.
 - (7) Maximum exposure temperature.
 - (8) Heater cable volts, current (operating/starting), and wattage (operating/starting).
 - (9) Electrical classification.
 - (10) Bill of materials.
 - (11) Trace ratio.
 - (12) Heat loss calculations.
 - (13) Heat loss rate per foot.
 - (14) Heater output rate.
 - (15) Branch circuit starting and continuous load amperes.
 - (16) The process line number protected by each circuit.
 - b. Provide total ampere loading (starting and continuous load amps), schematics and point-to-point wiring diagrams for all freeze protection control panels.
 - c. Installation details, instructions, and drawings outlining the recommended installation of heat trace for all Equipment including valves, instruments, taps, drains, junction boxes, power connections, etc.
 - d. Panel schedules indicating line numbers and system being protected.
 - e. Standard factory test records and reports.
 - f. Bill of materials.
 - g. Instruction and operation books.
 - h. Technical data for all components.
 - i. Commissioning reports including copies of all commissioning test reports.
 - j. Electrical Schematic.
 - (1) Detailed schematics showing all lights, switches, controllers, relays, timers, and all other wired equipment within the panel, associated with a systems control circuit.
 - (2) All voltage and current ratings and special wiring requirements shall be detailed.

- k. Physical diagrams of all supplied control panels (internal and external) showing all light and switches including color, all wiring internal to the panel, all tagging/labeling, and panel NEMA rating.
 - l. Equipment Installation Details. Drawings showing how to install all devices that require field installation with details including support/mounting devices, Instrument installation details inside instrument enclosures including tubing and isolation/drain valves and/or manifolds installation, etc.
 - m. A detailed list of all available I/O points, either hardwired or communication link.
 - n. Interconnection Wiring Diagrams. Overall system diagram showing 100% of the wiring required to interface with other plant systems (such as plant DCS).
 - o. Control logic diagrams to include normal start/stop sequence, alarm development, identification of all time delays, auto stop/start sequence, identification of digital control, and identification of analog control.
2. As constructed drawings showing actual locations of all system components shall be provided by Contractor at the completion of the project.
 - a. Drawings shall include general arrangement and elevation for actual locations of all devices.
- **260526 - Grounding**
1. Includes, but not limited to, catalog cuts for the following:
 - a. Cable.
 - b. Ground rods.
 - c. Connection materials.
 - d. Miscellaneous grounding Equipment.
- **260533 - Conduit and Accessories**
1. Catalog cuts.
 2. Electronic "Record Drawings" showing installation details (conduit size and location dimensions) for all conduits which are concealed, cast-in-concrete, buried, and home run circuits.
- **260536 - Cable Tray**
1. Construction details of all straight sections and fittings showing cross-sectional dimensions.
 2. Catalog cuts of installation and mounting materials used.
 3. Details of special support arrangements.
 4. Sample of labels for cable tray identification.
- **260543 - Underground Duct Banks and Manholes**
1. Catalog cuts
- **260551 - Alternating Current Electric Motors**
1. Submittals required include, but are not limited to, the following items:
 - a. Outline drawing for each group of identical motors.

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- b. Nameplate data for each group of identical motors rated 460 volts and below, including the following data:
 - (1) Manufacturer's name and serial number.
 - (2) Manufacturer's type and frame designation.
 - (3) Horsepower output.
 - (4) Time rating.
 - (5) Maximum ambient temperature for which motor is designed.
 - (6) Insulation system designation.
 - (7) Temperature rise and method of measurement.
 - (8) RPM at rated load.
 - (9) Frequency.
 - (10) Number of phases.
 - (11) Rated-load amperes.
 - (12) Voltage.
 - (13) Code letter for locked-rotor kVA.
 - (14) Design letter for polyphase integral-horsepower motors.
 - (15) Nominal efficiency for motors rated 1 through 199 horsepower.
 - (16) Service factor.
 - (17) For motors equipped with thermal protectors, the words "thermally protected."
- c. Nameplate data for each group of identical motors rated above 460 volts, including the following data:
 - (1) Manufacturer's name and serial number.
 - (2) Manufacturer's type and frame designation.
 - (3) Horsepower output.
 - (4) Time rating.
 - (5) Maximum ambient temperature.
 - (6) Insulation class.
 - (7) Temperature rise and method of measurement.
 - (8) RPM at rated load.
 - (9) Frequency.
 - (10) Number of phases.
 - (11) Voltage.
 - (12) Rated load amperes.
 - (13) Code letter.
 - (14) Service factor.
 - (15) Efficiency.
- d. Additional data for each group of identical motors rated above 100 horsepower:
 - (1) Acceleration time with connected load.
 - (2) Allowable locked rotor time.
 - (3) Starting capabilities.
 - (4) Thermal limit curve, superimposed on time-current curves during acceleration of the driven equipment at rated voltage and at minimum specified starting voltage.



- e. If requested by the Owner for 460-volt motors rated 1 through 199 horsepower, copies of test reports of efficiency and power factor tests performed on electrically duplicate motors.
 - f. Torque and speed curves.
 - g. For each motor rated above 460 volts, certified factory test report.
 - h. For each type of thermocouple furnished, manufacturer's standard calibration curve showing predicted millivolt output versus temperature.
 - i. For each type of resistance temperature detector furnished, manufacturer's standard calibration curve showing predicted resistance in ohms versus temperature.
2. Perform the following factory tests on each motor rated 460 volts and below in conformance with NEMA MG 1 and IEEE 112:
 - a. No-load current and speed at normal voltage and frequency.
 - b. High potential test.
 - c. Other standard factory tests.
 3. Perform the following factory tests on each motor rated above 460 volts in conformance with ANSI C50.41 and IEEE 112:
 - a. Measurement of winding resistance.
 - b. No-load readings of current, power, and nominal speed at rated voltage and frequency.
 - c. Mechanical vibration.
 - d. Direction of rotation versus phase sequence.
 - e. Insulation resistance.
 - f. High-potential test.
 4. Tests to confirm guaranteed sound pressure levels may be required at Owner's option and expense.
- **260810 - Electrical Testing**
1. Maintain a written record of all tests showing date, testing equipment, personnel making test, Equipment or material tested, tests performed, and results, including deficiencies found. Test reports shall include nameplate data of Equipment being tested.
 2. Complete test forms supplied by Contractor.
- **261200 – Oil Filled Small Power Transformers**
1. Includes, but not limited to, the following:
 - a. Outline drawings.
 - b. Nameplate drawings.
 - c. Wiring diagrams.
 - d. Schematic diagrams.
 - e. Instrument transformer performance curves and data.
 - f. Instruction books.
- **261200 – Dry-Type Small Power Transformers**
1. Includes, but not limited to, the following:
 - a. Outline drawings.

- b. Nameplate drawings.
 - c. Wiring diagrams.
 - d. Schematic diagrams.
 - e. Instrument transformer performance curves and data.
 - f. Instruction books.
 - g. Protective device coordination curves.
- **261313 - 4,160-Volt, 6,900-Volt, and 13,800-Volt Metalclad Switchgear**
- 1. Includes, but not limited to, the following:
 - a. Switchgear:
 - (1) Arrangement and outline drawings.
 - (2) Installation drawings.
 - (3) Bills of material.
 - (4) AC three-line diagrams.
 - (5) AC schematic diagrams.
 - (6) Wiring diagrams, including external connection terminals.
 - (7) Instrument transformer performance curves and data.
 - (8) Protective device coordination curves.
 - (9) Communications protocol information for all data communication devices and systems.
 - (10) Instruction books.
 - (11) Separate schematic and wiring drawings shall be submitted for each breaker furnished. "Typical" drawings covering several breakers will not be acceptable.
 - 2. Bus Duct:
 - a. Arrangement and outline drawings.
 - b. Installation drawings.
 - c. Bills of material.
 - d. Three-line diagrams.
 - e. Wiring diagrams.
 - f. Instruction books.
 - g. Support details.
 - h. Structural design calculations for bus duct supports shall be performed by a professional engineer licensed to practice in the jurisdiction where the project is located, and the data sheets shall be sealed by this professional engineer.
- **261923 – Medium Voltage Variable Frequency Drive Systems**
- 1. Includes, but not limited to, the following:
 - a. Variable Frequency Drives:
 - (1) Arrangement and outline drawings.
 - (2) Bills of material.
 - (3) One line, three line and schematic diagrams.
 - (4) Connection wiring diagrams, including external connections terminals.
 - (5) Tabulation of VFD settings.

- (6) Communications protocol information for all data communication devices and systems.
 - (7) Test reports.
 - (8) Installation, operation, programming and maintenance manuals.
 - (9) Torsional analysis report (if required).
 - (10) Spare parts recommendations and price list shall be submitted separately for VFD.
 - (11) Heat load for the VFD and input transformer.
 - (12) Harmonic calculations.
 - (13) Cable specifications.
 - (14) Main circuit breaker specifications.
 - b. Drive Isolation Transformers:
 - (1) Arrangement and outline drawings.
 - (2) Foundation interface drawings and load data.
 - (3) Space requirements on ventilated sides.
 - (4) Transformer nameplate data.
 - (5) Schematics and connection wiring diagrams.
 - (6) Bills of material.
 - (7) Test reports.
 - (8) Instruction manuals.
- **262300 - 480-volt Load Centers and Bus Equipment**
- 1. Transformers:
 - a. Transformer nameplate drawings.
 - b. Arrangement and outline drawings.
 - c. Installation drawings.
 - d. AC and DC schematic diagrams.
 - e. Wiring diagrams including external connection terminals.
 - f. Instrument transformer performance curves and data.
 - g. Instruction books.
 - 2. Load Centers:
 - a. Arrangement and outline drawings.
 - b. Installation drawings.
 - c. Bills of material.
 - d. AC three-line diagrams.
 - e. AC & DC schematic diagrams.
 - f. Wiring diagrams, including external connections terminals.
 - g. Instrument transformer performance curves and data.
 - h. Protective device coordination curves.
 - i. Communications protocol information for all data communication devices and systems.
 - j. Instruction books.
 - k. Separate schematic and wiring drawings shall be submitted for each breaker. "Typical" drawings covering several breakers will not be acceptable.
 - l. Details on insulating barriers between cable terminals and main bus.

3. Bus Duct:
 - a. Arrangement and outline drawings.
 - b. Installation drawings.
 - c. Bills of material.
 - d. Three-line diagrams.
 - e. Instruction books.
- **262400 - Panelboards, Switchboards and Transformers**
 1. General arrangement and outline information.
 2. Schematic power diagrams.
 3. Wiring diagrams.
 4. Bills of material.
 5. Nameplate information.
 6. Protective device coordination curves.
- **262419 - 480 Volt Motor Control Center Equipment**
 1. Arrangement and outline drawings.
 2. Bills of material.
 3. Installation drawings.
 4. Wiring diagrams.
 5. Schematic diagrams.
 6. Instrument transformer performance curves and data.
 7. Instruction books.
 8. Separate schematic and wiring drawings shall be submitted for each bucket. "Typical" drawings covering several buckets will not be acceptable.
- **262421 - 480-Volt Variable Frequency Drives**
 1. Submittals shall be custom prepared by the VFD system manufacturer for this specific application.
 2. Submittal information shall include, but not be limited to:
 - a. Equipment dimensions, including stub-up locations, shipping splits and shipping weights.
 - b. Block diagram showing the basic control and protection systems specifying the protection, control, trip and alarm functions at the different locations, the reference signals and commands and the auxiliary supplies.
 - c. Electrical one-line diagram showing main and auxiliary circuitry, including main power input, VFD, system grounding and auxiliary supplies.
 - d. Wiring diagrams, including external connection terminals.
 - e. Product data sheets.
 - f. Spare parts list.
 - g. Certifications.
 - h. Warranty.
 - i. Efficiency and power factor values.
 - j. Provide documentation on communication system interface along with a complete list of all available parameters and associated addresses.
 - k. Provide documentation of the controller program settings.



3. Final documentation shall include the following:
 - a. Start-up and commissioning instructions and data.
 - b. Certified “as-built” drawings of all Equipment with information listed above.
 - c. Factory test report.
 - d. Operation and maintenance manual.
 - e. Manufacturer’s service and repair support during and after warranty.
 - f. Spare parts lists with supplier names and part numbers.
 - g. Provide documentation of the controller program settings and settings file if applicable.
- **262900 - Power Switching and Control Devices**
 1. Outline information.
 2. Internal arrangement information.
 3. Schematic power and control diagrams.
 4. Wiring diagrams.
 5. Protective device coordination curves.
- **263353 - Uninterruptible Power System**
 1. Arrangement and outline drawings.
 2. Installation drawings.
 3. External connection diagrams.
 4. Schematic diagrams.
 5. Bills of material.
 6. One-line diagrams.
 7. Instruction books.
 8. Protective device coordination curves.
 9. Efficiency curves (showing heat losses).
- **264100 - Lightning Protection Systems**
 1. General arrangement and outline information.
 2. Bills of material.
 3. Instruction books.
 4. Technical Specifications for all components.
 5. Mounting details for all components.
 6. Detailed layout drawings.
- **264200 - Cathodic Protection Equipment and Materials**
 1. Cathodic protection rectifiers.
 2. Anode junction box.
 3. Impressed current anodes.
 4. Galvanic anodes.
 5. Cathodic protection wire.
 6. Coke-breeze.
 7. Exothermic weld equipment.
 8. Ground rod.
 9. Ground wire and clamp.

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10. Conduit.
 11. Concrete terminal boxes with terminal boards and shunts.
 12. Plastic caps for exothermic welds.
 13. Temporary fill pipe.
 14. Vent pipe.
 15. Centering spacer.
 16. Ties.
 17. Supports, anchor bolts.
 18. Well casing pipe.
 19. Gravel backfill gradation.
 20. Painting procedure, including color chart.
 21. Permanent reference electrodes.
 22. Rheostat control boxes.
 23. Test coupons.
- **264210 - Cathodic Protection Installation**
1. Test report including all data, analysis, and recommendations on field testing.
- **265000 - Lighting, Receptacles and Controlling Devices**
1. Information for each light fixture, switch, receptacle outlet, and accessories.
 2. In the event of a proposed substitution of the lighting fixture specified, Contractor shall submit the following information to Owner for approval before an order is placed for such fixtures:
 - a. A complete fixture description.
 - b. A complete set of photometrics for proposed fixture.
 - c. If required by Owner, operating sample units of fixtures proposed as substitutes to those specified.
- **0275116 – Intercommunications and Public Address System**
1. Schematic power and control diagrams.
 2. General arrangement and outline information.
 3. Bills of material.
 4. Instruction books.
 5. Technical Specifications for all components.
 6. Mounting details for all components.
- **409125 – Measurement and Control Instrumentation for Packaged Systems**
1. Bill of materials.
 2. Manufacturers' specification sheets.
 3. Outline drawings.
 4. Calibration forms.
 5. Certificates of completion of factory tests.
 6. Welding procedures.
 7. Welding qualification test records.
 8. Instrument stand drawings to indicate:
 - a. Instrumentation mounting and construction features, bracing, brackets, device mounting holes, and all dimensions for assembly.

- b. Mounting locations for all devices to be mounted. Complete bill of material for all items required for instrument mounting, instrument rack or heated instrument enclosures.
 - c. Listing of each instrument mounted on a stand by tag number.
 9. Submit certified test reports and mill certification sheets for all tubing materials, except copper, in accordance with ASTM A1016/A1016M, section 28, including at least the following:
 - a. ASTM specification and grade.
 - b. Chemical analysis.
 - c. Hardness test.
 - d. Tensile properties.
 10. Instruction books for installation, operation, calibration and maintenance for each instrument and device.
 - a. Wiring diagrams which identify terminal numbers in the associated terminal boxes for field cables.
 11. Instrument hookup drawings of process sensing and pneumatic lines showing the piping, tubing, fittings and valves used for each type of installation, instrument application, or special case involving water level columns, signal transmissions, and motive air.
 12. System diagrams including sufficient detail to define the recommended operational requirements of the process and the procedures for start-up, operation and shutdown. Specific system diagrams furnished shall include at least the following:
 - a. Process and instrumentation diagrams (P&ID).
 - b. Logic diagrams.
 13. Submit to the Owner and Owner's Engineer daily calibration Work schedule.
 14. Test equipment calibration records. Submit for review prior to their use for each device calibration.
 15. Reference gas certification records. Submit for review prior to their use for each device calibration.
 16. Completed calibration sheets.
 17. Drawings of typical installations will be acceptable when all individual applications are listed.

➤ **409513 - PLC Control Cabinets**

1. Submittals required shall include the following:
 - a. Seller's factory test report.
 - b. Instruction books and operating manuals.
 - c. Drawings, wiring diagrams, product data, and other items specified.

➤ **411209 – Belt Conveyors**

1. Hydraulic take-up logic.
2. Special start-up logic (if required).
3. Standard details.
4. Pulley and bearing schedule.
5. Drive schedule.



- **411215 – Portal Scraper-Reclaimer**
 1. Detailed general arrangements.
 2. One-line wiring diagrams.
 3. Complete foundation loads, requirements and anchor bolt requirements.
 4. Complete field wiring schematics.
 5. Complete control logic diagrams.
 6. Complete internal wiring diagrams.
 7. Complete hydraulic schematics.
 8. Instruction manuals.

- **411217 – Pipe Conveyors**
 1. Hydraulic take-up logic.
 2. Special start-up logic (if required).
 3. Standard details.
 4. Pulley and bearing schedule.
 5. Drive schedule.

- **411230 – Chutes, Hoppers, and Gates**
 1. General arrangement drawings.
 2. Liner plate cutout and bolt location drawings (two sets at end of job).
 3. Gate operators including applicable schematics (electric, hydraulic, air).

- **411240 – Wet Suppression Systems**
 1. Includes, but not limited to, the following:
 - a. Complete one-line flow diagrams.
 - b. Equipment drawings.
 - c. Internal electrical schematics.
 - d. Field wiring diagrams.
 - e. Heat tracing wiring.
 - f. Instruction manuals.

- **411323 – Apron Belt Feeder Unloading System**
 1. Includes, but not limited to, the following:
 - a. General arrangements.
 - b. Special start-up logic (if required).
 - c. Standard details.
 - d. Shaft and bearing schedule.
 - e. Drive information.
 - f. Vender component drawings and catalog cuts.

- **411435 – Belt Scales**
 1. Scale general arrangement.
 2. Calibration chain.
 3. Chain rack and/or reel.
 4. Field wiring schematics.
 5. Internal wiring diagrams.



6. Electrical equipment drawings.
 7. Instruction manuals.
 8. Recommended spare parts list.
- **411525 – Control Devices for Material Handling**
1. Furnish complete master device list, or bill of material of all electrical equipment, devices, and accessories by this Agreement. This shall include the following for each device:
 - a. Tag number.
 - b. Manufacturer.
 - c. Data or specification sheet number, if any.
 - d. Scheduling information, showing dates for ordering, fabrication, shipment, and the like.
 2. Furnish outline drawings for each type of device furnished. One drawing may be used for all devices of the same type, but the drawing shall be marked to list the tag numbers of all devices to which it applies. Outline drawing shall clearly show terminal arrangement and numbering.
 3. In addition to the above, Contractor shall prepare a set of system flow diagrams locating all control devices furnished. A separate flow diagram shall be submitted for each of the following groups:
 - a. Belt misalignment switches.
 - b. Emergency pull cord switches.
 - c. Under-speed switches.
 - d. Plugged chute switches (tilt type, ultrasonic and nuclear).
 - e. Solenoid valves (air blasters and the like).
 - f. Position limit switches (tripper) (and) (shuttle) travel, telescoping chute, take-up over travel, flop gate position, slack cable, belt rip, and the like).
 - g. Vibration switches.
 - h. Material level switches and monitors.
 - i. Warning bells and horns.
 - j. Warning lights (beacons and strobes).
 4. Complete mounting details for each type and application of switch.
- **412433 – Magnetic Separators**
1. Submittals required shall include, but are not limited to, the following:
 - a. Separator general arrangement.
 - b. Rectifier cabinet.
 - c. Field wiring connections.
 - d. Internal wiring diagrams.
 - e. Suspension arrangement.
 - f. Instructions manuals.
- **412436 – Metal Detectors**
1. Submittals required shall include, but are not limited to, the following:
 - a. Detector general arrangement.
 - b. Field wiring schematics.

- c. Internal wiring diagrams.
 - d. Instruction manuals.
 - e. Accessories.
- **485280 – Fly Ash and Gypsum Equipment**
1. Submittals required shall include the following:
 - a. General arrangement and outline information.
 - b. Foundation design information.
 - c. Structural fabrication information.
 - d. Piping fabrication information.
 - e. Erection information.
 - f. Internal arrangement information.
 - g. Piping connection information.
 - h. Valve information.
 - i. Instrumentation information.
 - j. Block and/or logic control diagrams.
 - k. Wiring diagrams.
 - l. Electric motor data.
 - m. Bills of material.
 - n. Test information.
 - o. Nameplate information.
- **485285 – Gypsum Dewatering System**
1. Submittals required shall include the following:
 - a. General arrangement and outline information.
 - b. Foundation design information.
 - c. Structural fabrication information.
 - d. Erection information.
 - e. Piping connection information.
 - f. Valve information.
 - g. Instrumentation information.
 - h. Block and/or logic control diagrams.
 - i. Wiring diagrams.
 - j. Electric motor data.
 - k. Bills of material.
 - l. Test information.
 - m. Nameplate information.
 - n. Material balance for gypsum dewatering system.
- **485290 – Ash Handling Piping, Valves and Fittings**
1. Submittals required shall include the following:
 - a. General arrangement and outline information.
 - b. Foundation design information.
 - c. Structural fabrication information.
 - d. Erection information.
 - e. Piping connection information.

- f. Valve information.
 - g. Bills of material.
 - h. Test information.
- **485295 – Ash Handling Instruments and Controls**
- 1. Submittals required shall include the following:
 - a. General arrangement and outline information.
 - b. Foundation design information.
 - c. Internal arrangement information.
 - d. Piping connection information.
 - e. Instrumentation information.
 - f. Logic control diagrams or logic narrative
 - g. Graphis screens and control menus.
 - h. Wiring diagrams.
 - i. Printed circuit board information.
 - j. Bills of material.
 - k. Test information.
 - l. Nameplate information.
- **485422 – Horizontal End-Suction Pumps**
- 1. Standard performance curves covering the range from shutoff to 120% of design flow rate and for the following parameters as a function of capacity at design temperature.
 - a. Total developed head.
 - b. Required NPSH.
 - c. Efficiency.
 - d. Required brake horsepower.
 - 2. Submit the following drawings:
 - a. Cross-section of seal housing showing seal arrangement, type, manufacturer, and model number.
 - b. Schematic of seal and bearing water piping arrangement.
 - c. Seal injection and bearing water requirements.
 - d. Foundation details with loads, base plate bolt configurations, and other data as required for foundation design.
 - e. Piping connection information showing:
 - (1) Size, type, and location for each connection.
 - (2) Allowable forces and moments on each connection.
 - f. Bill of material.
 - 3. Submit test reports and performance data specified.
 - 4. Motor performance data and results of shop test.
- **485435 – Vertical Can Pumps**
- 1. Standard performance curves covering the range from shutoff to 120% of design flow rate and for the following parameters as a function of capacity at design temperature.
 - a. Total developed head.



- b. Required NPSH.
- c. Efficiency.
- d. Required brake horsepower.
2. Submit the following drawings:
 - a. Cross-section of seal housing showing seal arrangement, type, manufacturer, and model number.
 - b. Schematic of seal and bearing water piping arrangement.
 - c. Seal injection and bearing water requirements.
 - d. Foundation details with loads, base plate bolt configurations, and other data as required for foundation design.
 - e. Piping connection information showing:
 - (1) Size, type, and location for each connection.
 - (2) Allowable forces and moments on each connection.
 - f. Bill of material.
3. Submit test reports and performance data specified.
4. Motor performance data and results of shop test.

➤ **485460 – Horizontal Hard Metal Slurry Pumps**

1. Standard performance curves covering the range from shutoff to 120% of design flow rate and for the following parameters as a function of capacity at design temperature.
 - a. Total developed head.
 - b. Required NPSH.
 - c. Efficiency.
 - d. Required brake horsepower.
2. Submit the following drawings:
 - a. Cross-section of seal housing showing seal arrangement, type, manufacturer, and model number.
 - b. Schematic of seal and bearing water piping arrangement.
 - c. Seal injection and bearing water requirements.
 - d. Foundation details with loads, base plate bolt configurations, and other data as required for foundation design.
 - e. Piping connection information showing:
 - (1) Size, type, and location for each connection.
 - (2) Allowable forces and moments on each connection.
 - f. Bill of material.
3. Submit test reports and performance data specified.
4. Motor performance data and results of shop test.

➤ **485502 – Compressed Air System Equipment**

1. General arrangement and outline drawings.
2. Foundation design information including static/dynamic loads, and anchor bolt size and arrangement.
3. Piping layout and connection information.
4. Rated capacities of air compressors, after-coolers, air dryers, filters, and automatic drains.

5. Equipment shipping, installed, and operating weights.
 6. Certificates of shop inspection and data report: as required by ASME Boiler and Pressure Vessel Code.
 7. Wiring diagrams: for each item of Equipment with electric power supply. Include ladder-type wiring diagrams for interlock and control wiring.
 8. Bills of material.
 9. Nameplate information.
 10. Information on materials of construction.
 11. Complete lubrication system information.
 12. Acceptable lubricant manufacturer information.
 13. Surface preparation and painting specification information.
 14. Drawings showing additional detail if requested by engineer, and as required for installation and maintenance.
- **485660 – Field Erected Tanks**
1. Outline and general arrangement drawings showing all supports, connections, weights, and clearances required.
 2. Drawings showing location and details of connections.
 3. Drawings showing anchor bolt sizes and locations and base plate details.
 4. Drawings showing details of tank accessories.
 5. Welding procedures.
 6. Welders' qualification test records prior to beginning production welding.
 7. Bills of material.
 8. Drawings showing additional detail if requested by engineer and as required for the erection and maintenance of each tank and/or accompanying accessories.
 9. Surface preparations and painting procedures.
- **485935 – Power Piping Welding and Fabrication**
1. Welding procedures as specified.
 2. Welders' qualification test records as specified.
 3. Post-heat treatment temperature records as specified.
 4. ASME manufacturer's data reports for piping as required by ASME B31.1 and the ASME Boiler and Pressure Vessel Code.
- **485940 – Power Piping Hangers and Supports**
1. Detail drawings of engineered hanger assemblies on 8-1/2"x11" sheets indicating the following:
 - a. Illustrate each support in the install position. Show each support correctly oriented with respect to piping and building structure. Hanger drawings shall have a bill of material list referenced by part number to the hanger illustration. Indicate in the plan view location of the support attachment to the building structure including the orientation and elevation of added supplementary steel or existing steel, and support attachment to the piping for each support. All field welds shall be shown and sized.
 - b. Plan location of the piping.
 - c. Plan locations of the hanger attachment to the steel and to the pipe.

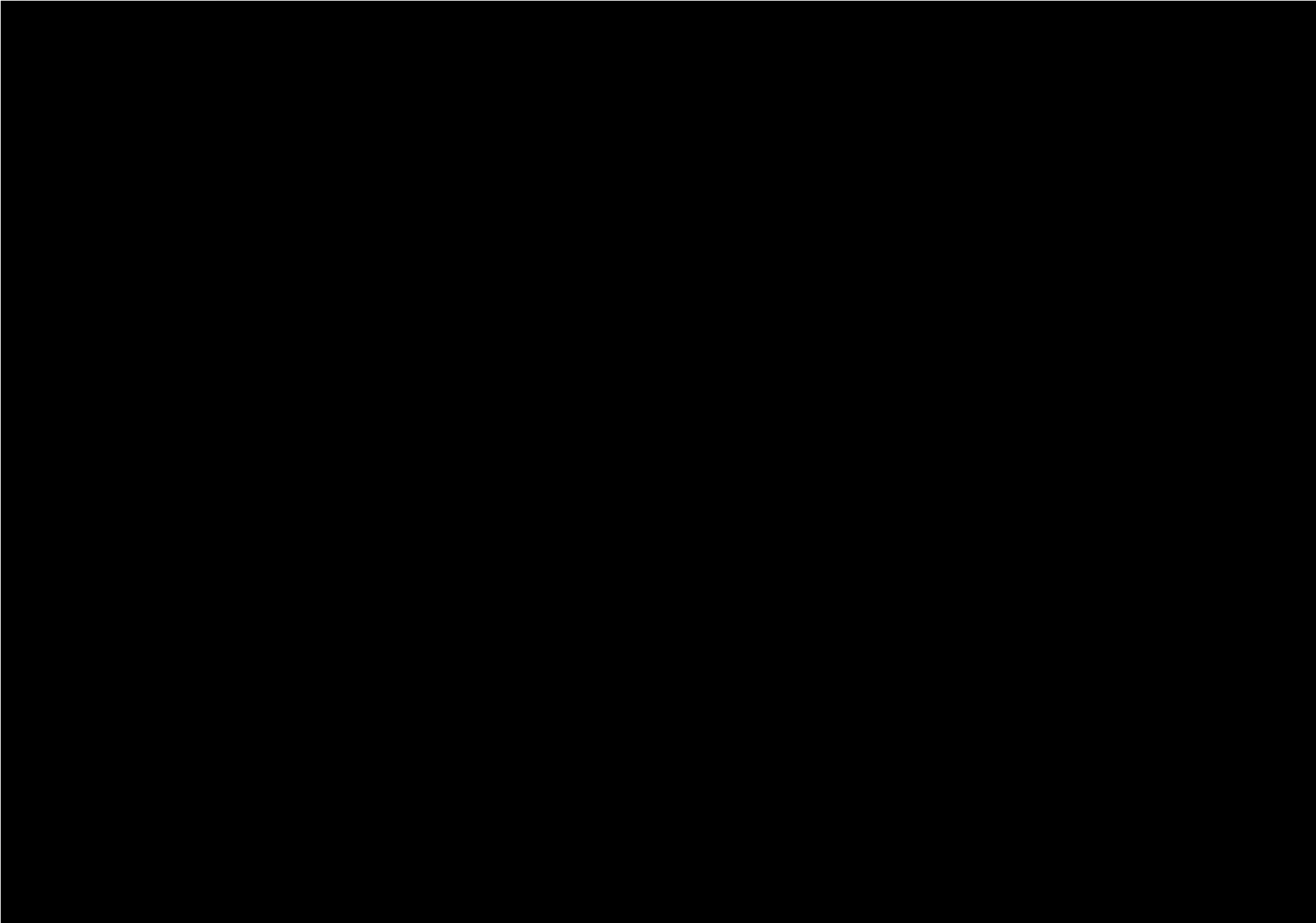
- d. Location and size of all supplementary steel.
 - e. Elevation location of the support steel.
 - f. Elevation location of the piping.
 - g. Total hanger load.
 - h. Complete bill of material referenced with part number to the hanger illustration.
 - i. Hanger tagging designations shall be in a manner as approved by Owner.
 - j. Equipment connection reaction list.
 - k. Concrete pad, grout, and foundation details.
 - l. Supports from suspended concrete slabs require Owner review and approval.
2. Hanger load calculations if requested.
 3. Certificate of completion of factory tests, where applicable.
 4. Submit hanger detail drawings by piping system in loose-leaf binders on the first submittal with a separate binder for each set of copies. Submit only a completed system set of drawings covering all the hangers in a system on the first submittal. Each complete system set shall include index cover sheet. Index cover sheet shall indicate support tag numbers, number of sheets for each support revision, and date issued of each support. On revised submittals, submit individual revised detail sheets with the revised index sheets indicating supports that have been revised.
- **485965 – Equipment Erection**
1. Welding procedures as specified.
 2. Welders' qualification test records as specified.
 3. Weld inspection reports as specified.
 4. Post-heat treatment temperature records as specified.
 5. Pipe hangers.
 6. Touch-up paint.
 7. Detailed erection procedures for the following:
 - a. Remote and/or local submerged flight conveyors.
 8. Detailed power station crane load test procedure.
- **485990 – Erection and Installation of Power Piping**
1. Welding procedures as specified.
 2. Welder's qualification test records as specified.
 3. Hanger and support adjustment reports as specified.
 4. Post-heat treatment temperature records as specified.
 5. Data reports as required by ASME B31.1 and the ASME Boiler and Pressure Vessel Code.

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CONFIDENTIAL INFORMATION REDACTED

Trimble County CCRT
Exhibit X Appendix A - SUBMITTAL SCHEDULE
Engineering Procurement and Construction Agreement

LG&E
KU

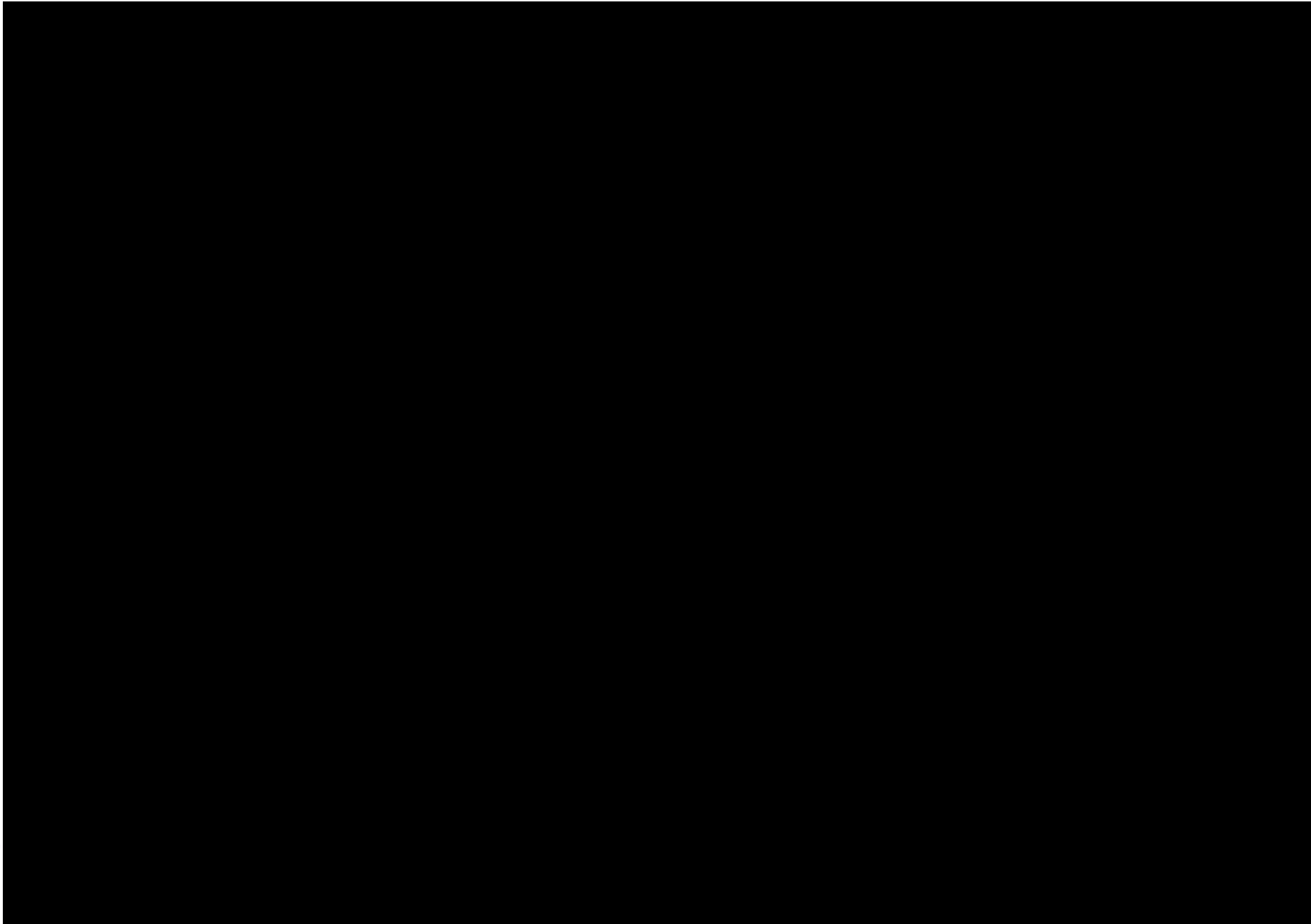


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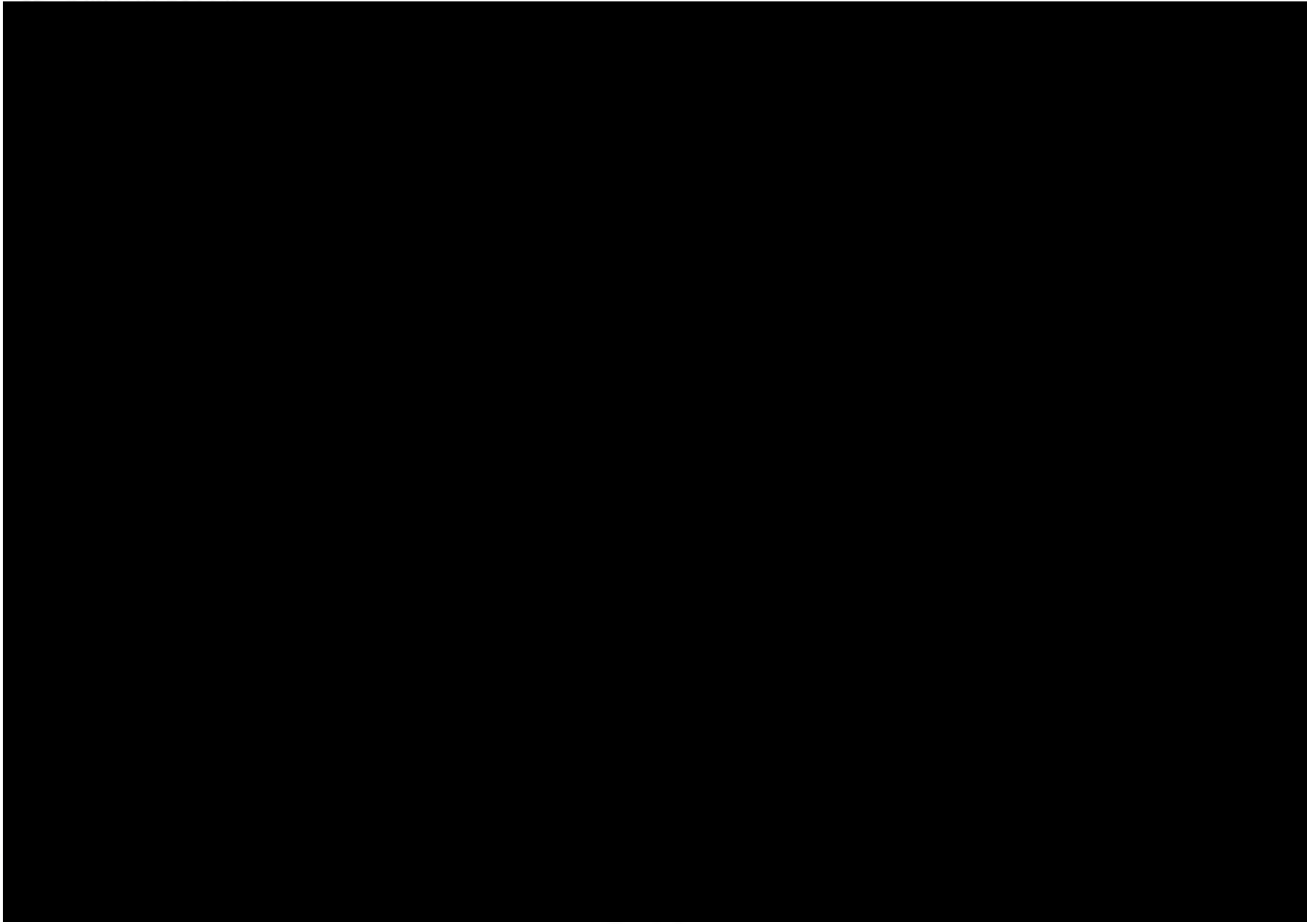
Trimble County CCRT
Exhibit X Appendix A - SUBMITTAL SCHEDULE
Engineering Procurement and Construction Agreement

LG&E
KU



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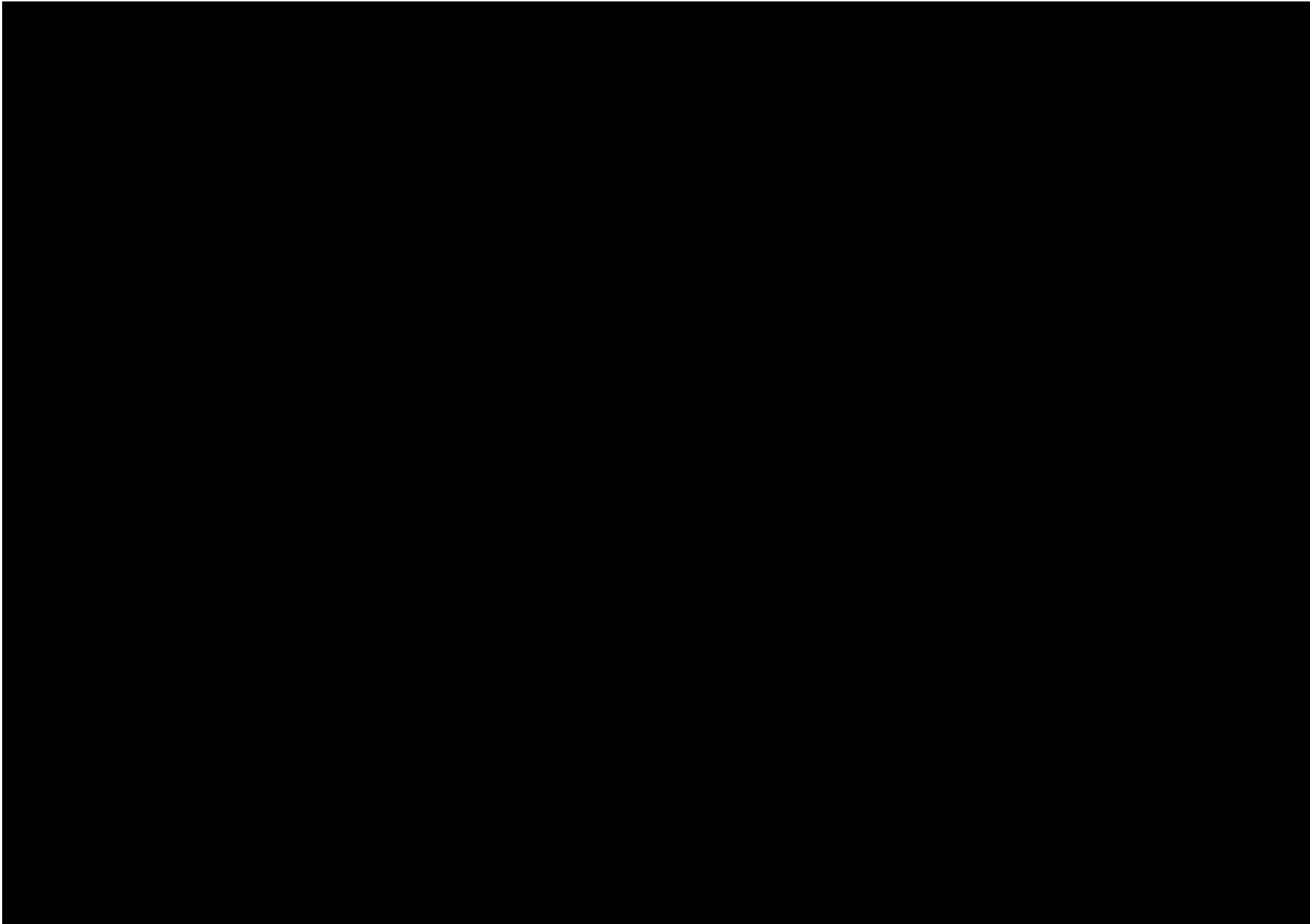


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A stylized signature or initials, possibly "P" or "R", is written vertically on the left margin.
Below it, the letters "AIR" are written in a similar blue ink style.

CONFIDENTIAL INFORMATION REDACTED

Trimble County CCRT
Exhibit X Appendix A - SUBMITTAL SCHEDULE
Engineering Procurement and Construction Agreement

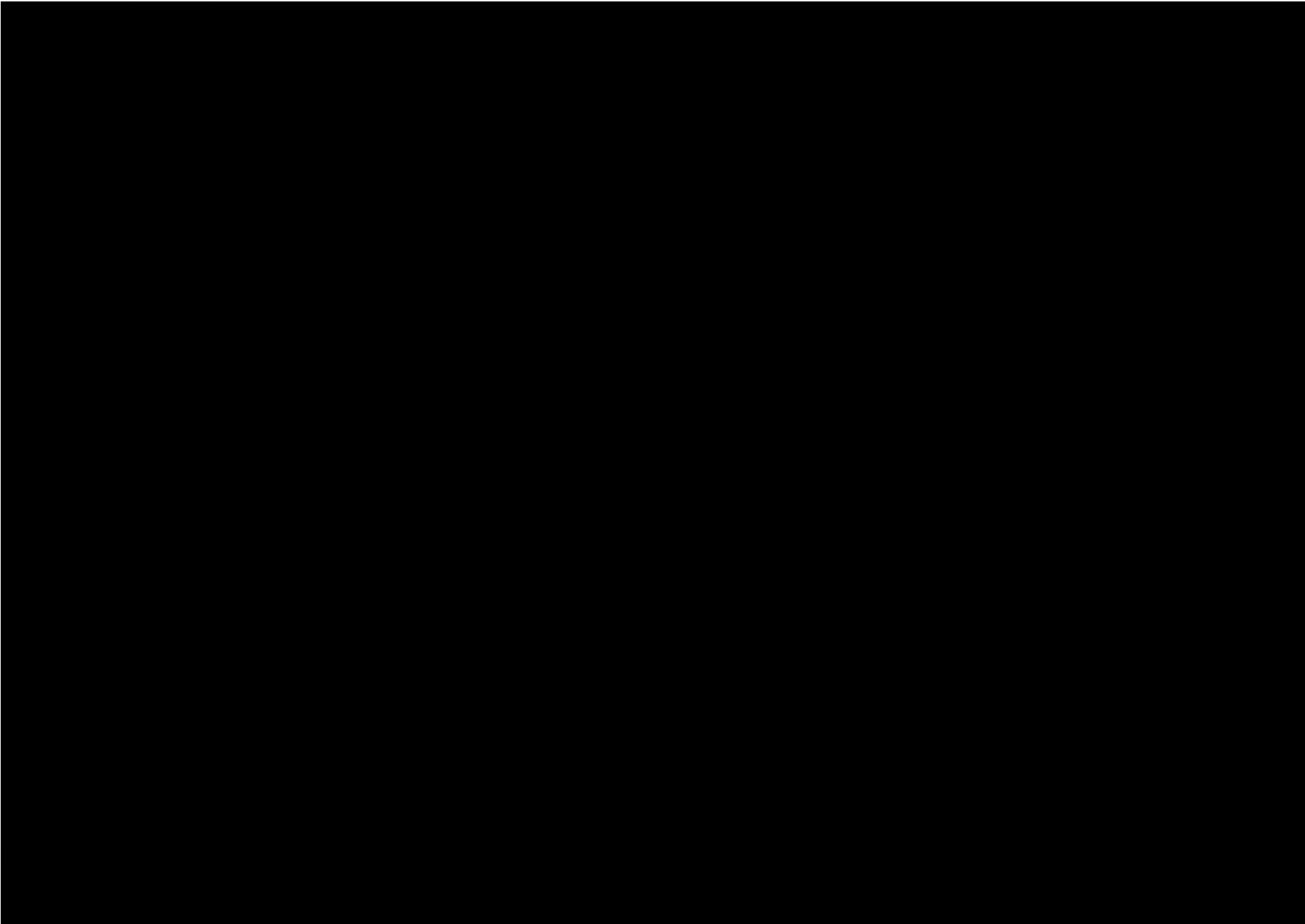
LG&E
KU



*J
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Trimble County CCRT
Exhibit X Appendix A - SUBMITTAL SCHEDULE
Engineering Procurement and Construction Agreement

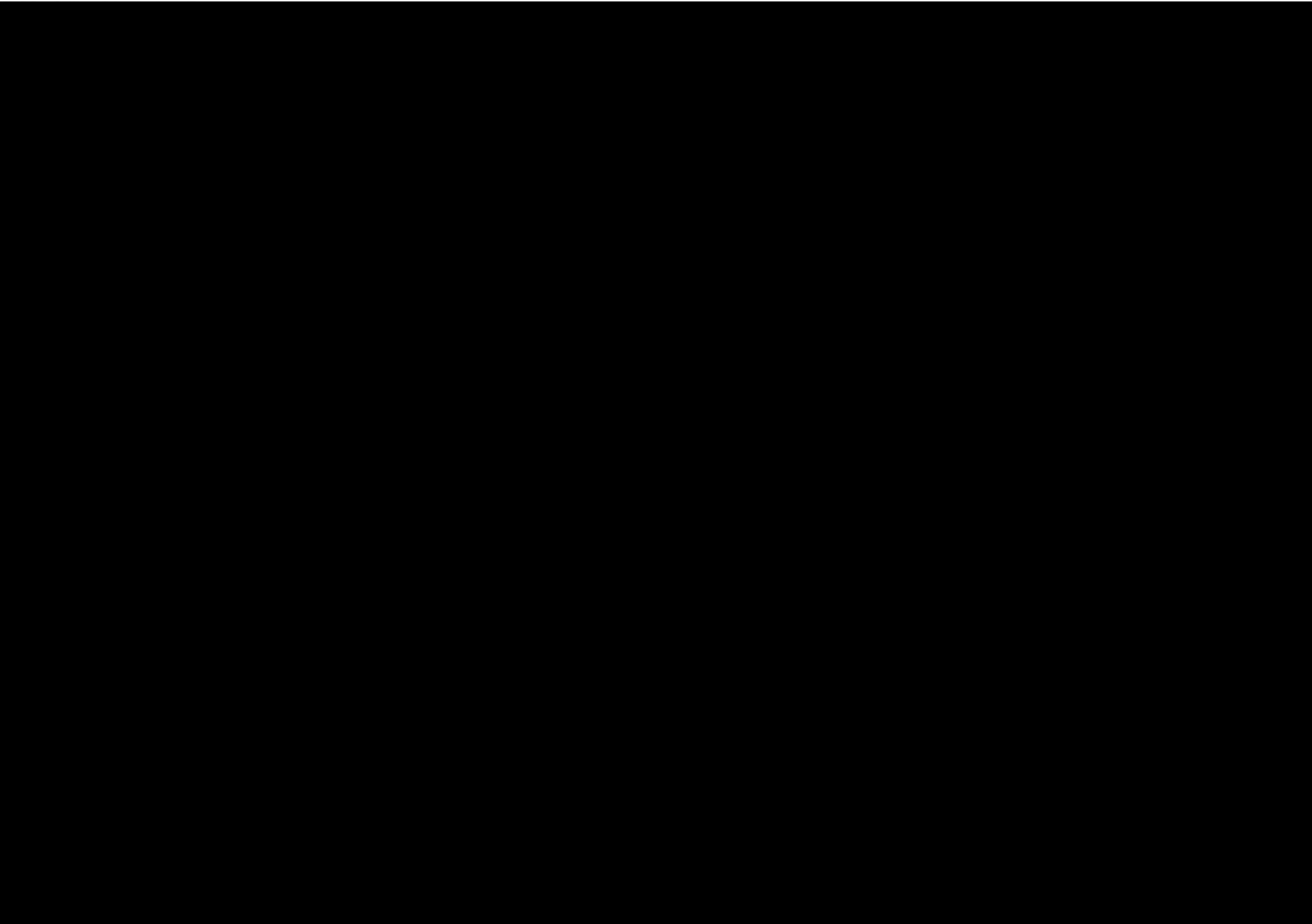
LG&E
KU



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Trimble County CCRT
Exhibit X Appendix A - SUBMITTAL SCHEDULE
Engineering Procurement and Construction Agreement

LG&E
KU



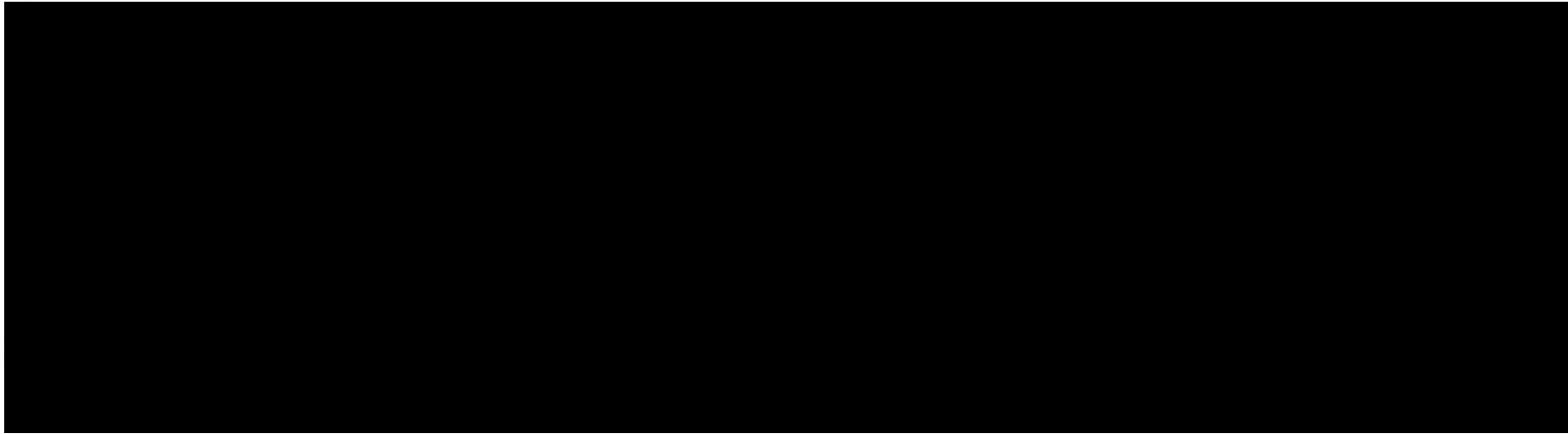
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CONFIDENTIAL INFORMATION REDACTED

Exhibit 2

Trimble County CCRT
Exhibit X Appendix A - SUBMITTAL SCHEDULE
Engineering Procurement and Construction Agreement

LG&E
KU



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Overview:

The following procedure is for vendors, suppliers, and contractors who will be issuing submittals to Burns & McDonnell (BMcD). If you have questions about uploading submittals, please email or call your BMcD contact.

It is a step by step guide on:

- Login options
 - Logging in
 - Resetting the Password
 - Forgotten Passwords
- Preparing and Delivering a Submittal
 - Creating a Submittal
 - Notification of Receipt
- Picking up a Reviewed or Rejected Submittal
 - Notification of Completed/Rejected Documents
 - Download of Completed/Rejected Documents



Logging In:

Log into BMcD WebTools at <http://webtools.burnsmcd.com> using the username and password sent to you by Burns and McDonnell's IT support group.

Note: Accounts are user specific. Do not share the username and password. Others who wish to access the system should request a separate account.

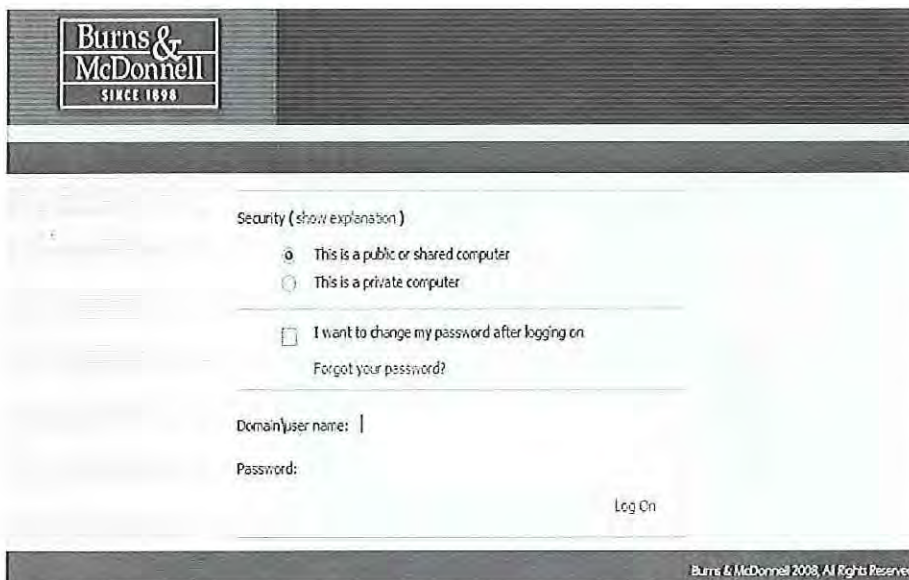
Previously you were not able to change the password you received, but now it can be reset after using the initial password from BMcD. After changing the password it cannot be changed again for 24 hours. Previously used passwords cannot be used again. The Domain is BMCDEXT and should preface your username.

To Login:

The Domain is BMCDEXT\ and should be typed in before the user name. **NOTE: Make sure you select this is a private computer-this will remember your login information so you will not have to type in your username and password again. Example: BMCDEXT\[user ID] so the information would be BMCDEXT\ext_jdoe.**

- a. You may change your password by checking the box for I want to change my password after logging on.
- b. If you forgot your password you can have a new password sent to you by clicking the "Forgot your password?"

Login Screen:



Je
AKR

Set New Password screen:



- The new password must meet BMcD password requirements:
- The password has to be at least eight characters long.
- The password must contain characters from at least three of the following categories:
 - English uppercase characters (A - Z)
 - English lowercase characters (a - z)
 - Base 10 digits (0 - 9)
 - Non-alphanumeric (For example: !, \$, #, or %)
 - The password cannot contain three or more characters from the user's account name.



Jr
AKR

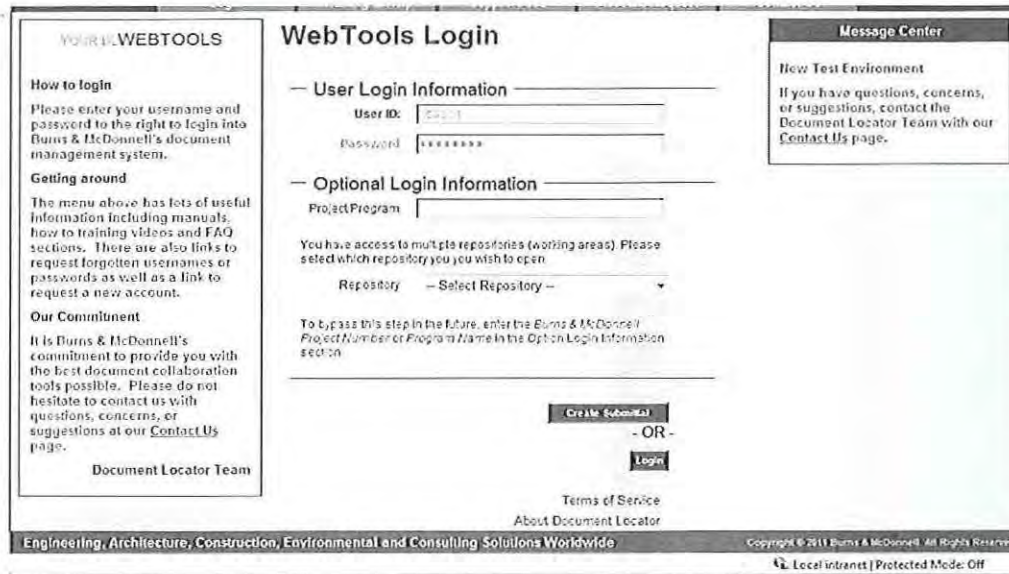
If you forgot your password you can have a new password sent to you by clicking the “Forgot your password”. If so, the following screen will appear for requesting a new password.

Request New Password screen:



Creating a Submittal:

If your password does not need to be changed, use your current User ID and Password to log into WebTools.



*For
copy*

Your username and password information will be automatically populated into the BMcD Login screen.

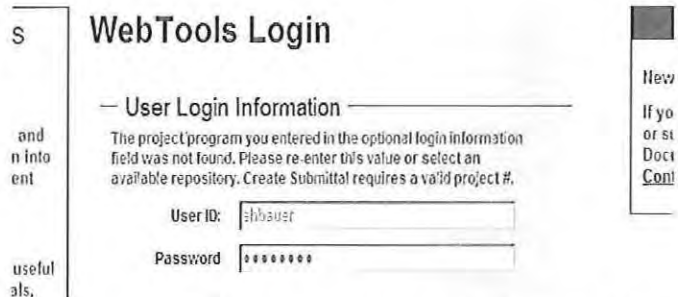
- To create a submittal click in the Project/Program text box and fill in with the appropriate project name or program number, then click Create Submittal.

If a reminder of the appropriate project number is needed, log in to WebTools and view the available project number folders. By clicking on the “Documents” folder the list of available project number will be seen. Descriptions of those projects will be given on the right hand window pane. After the proper project number is verified, log back out to return to the Create Submittal option.

Note: When creating a Submittal, the Repository information is not needed.

If the number is incorrectly entered the following error message will be displayed.

Check the number, if you believe you received this message in error you will need to contact your BMCD Document Control contact.



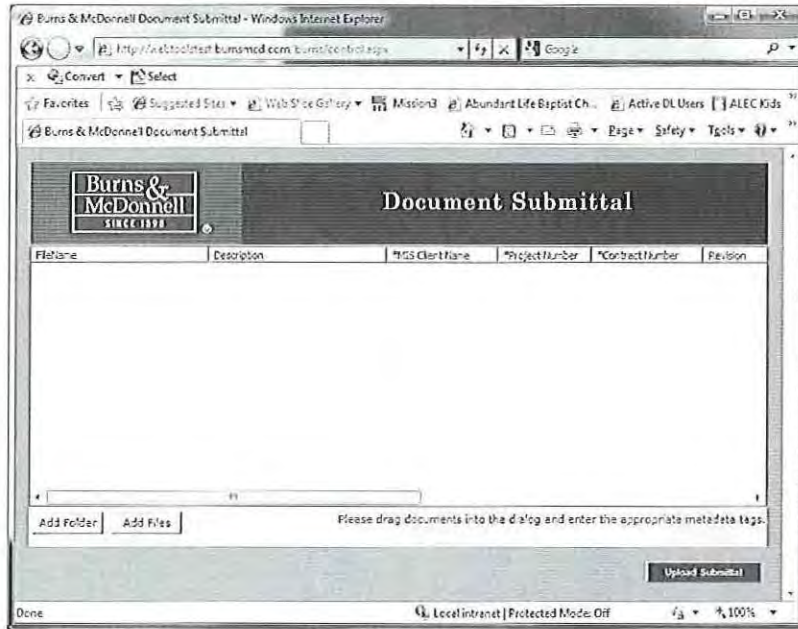
- If this is the first time you are visiting the Submittal screen then you will be prompted to load the ActiveX Add-On that will allow you to drag and drop documents into the screen. Click on Install to load the ActiveX Add-On.

Note: Some companies prohibit the install of an ActiveX Add-On. If this is the case for your system administrators please contact your BMcD representative.



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- After installing the Active X component, the window is now ready for files to be drag and dropped directly into the grid part of the window.



2. Select the files from your system and drag them into the window.



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One of three options may be used in the Create Submittal window:

- Drag and drop a File
- Drag and drop a Folder
- Use the Add Folder or Add Files buttons in the Document Submittal window.

Note: For document types and filenames see section 1.02 E of the 013300, 013301, 013304 or 013305 General Requirements specification.

A transmittal number will be assigned to the Submittal upon receipt. If preferred, a transmittal may be created and added to the list of files as a separate document. Please check with your project team for specific submittal needs.

- The Filename, client name, and project number will be pre-populated in the Create Submittal window. Before dragging the files into the window make sure they follow the file naming requirements.
- **Filename** should be the same as the Drawing Name or Document Number.

Do not include the following in the filenames:

- a. Revision
- b. Dates
- c. File Description or Document Title
- d. Transmittal Information

Note: If the document is being resubmitted then the filename must match EXACTLY with the previous submittal name.

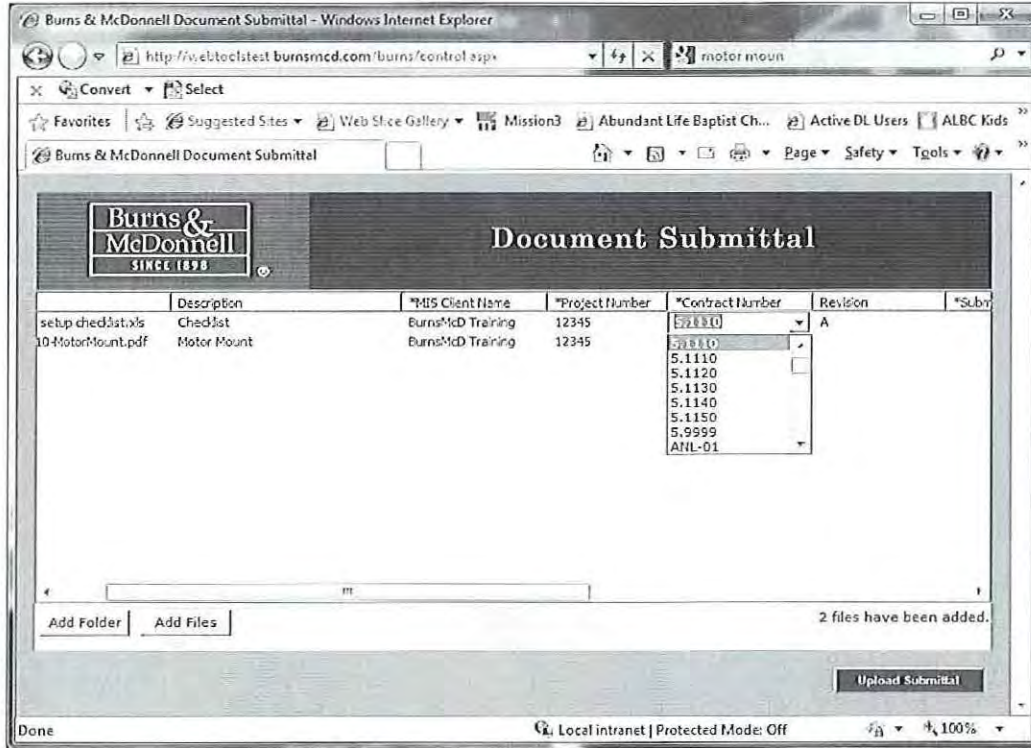
Valid filename examples: A07-9877-8-1.pdf, M-114-1-par.pdf, A-347-wps.pdf, 18555-18 ASME calcs.pdf, Terminal Point List.pdf

- **Description** is required and should relate to the **document title** from the title block of the drawing.
Valid description include: General Arrangements, Weld Procedures, Code Calcs, Terminal Point List, Wiring Diagram – Analyzer.
- **Revision** should be the actual revision from the document title block. If the document does not have a revision enter a dash/hyphen (-).
- Items with an * in the column name are required. Items that do not include the * may still be required by your project. Please fill in as much detail as possible unless directed otherwise by your BMCD Document Control contact.

Note: Columns in the window may be resized as needed. If a drop down list is supplied then only those values may be selected. To narrow a list of items or if a value is known, it may be typed or the copy/paste option may be used into the drop down.



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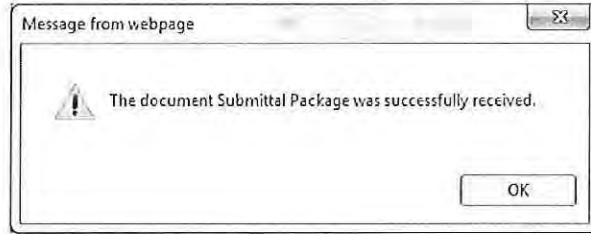


3. Click on the Upload Submittal and the files will begin to load.



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- 4. When complete you will be prompted that the Package was successfully received. Click OK and you will be returned to the Login Window.



Notification of Receipt:

Within a few minutes you will receive an email notice that will include a link to a transmittal receipt. If there is a correction made to the submittal you may receive an additional notice that will include a link to the updated transmittal receipt.

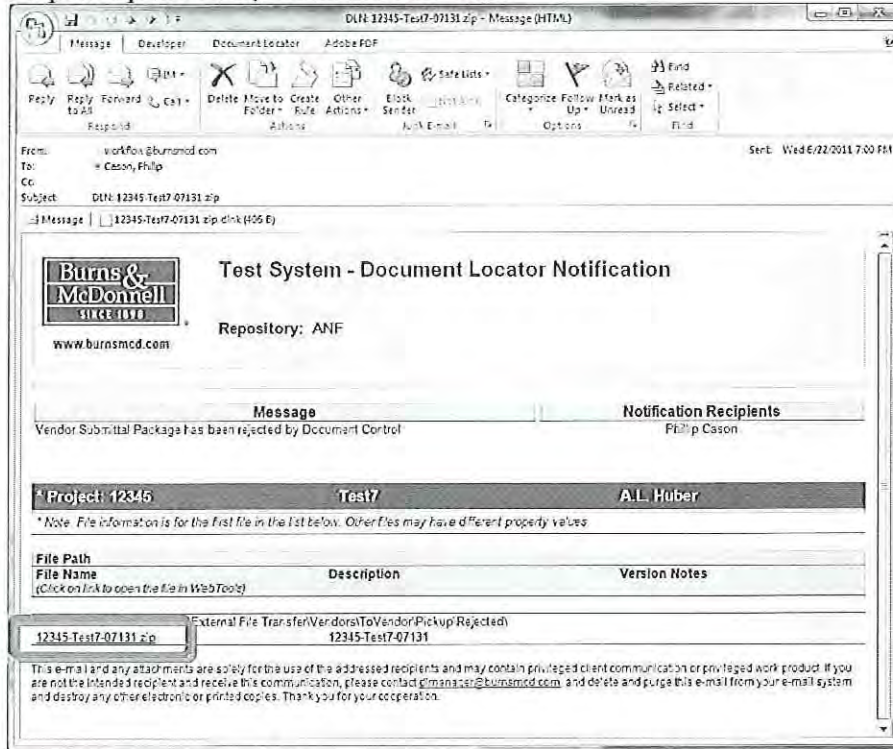


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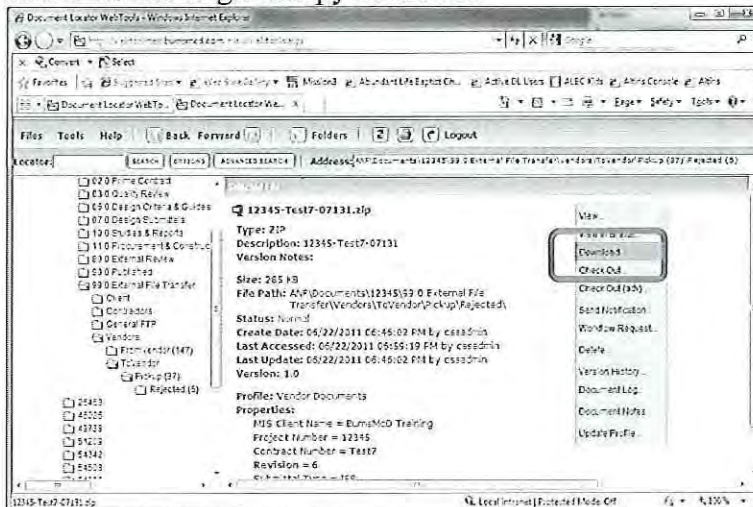
Picking up a Reviewed Submittal

If your Submittal is being return after a review or is rejected, you will receive an email from the system with a link to a zip file consisting of the files.

1. To pick up the files, Click the File link.



2. After logging into WebTools you will be directed to the document for pickup. Click on Download to get a copy of the file.



3. Select a location on your hard drive to save the file and click ok.





Generation Services

**Specifications for
Electronic Submittal of
Cable Tabulation Records
LKE_CT_06.15**

**June 2015
Rev 6**

JK
AKR

**Specification for Electronic
Submittal of Cable Tabulation Records****LG&E / KU
Generation Services****LG&E / KU Specifications for
Electronic Submittal of Cable Tabulation Records****1. Introduction**

- 1.1. This data submittal would be used for custom engineered projects or systems where individual wires and cables are tracked throughout the design process. This document would typically be provided to Architects and Engineering firms. It is the responsibility of the Architect or Engineering Firm to ensure that each of their subcontractors who may be supplying cable tabulations receives and follow these submittal requirements.
- 1.2. LG&E / KU Generation utilizes one application for electronic storage and retrieval of cable tabulation records:
Drawing Management System (with Cable Tab Management)
- 1.3. Project records are to be submitted to the LG&E / KU project manager per these specifications.
- 1.4. Final documentation shall include the most recent revisions and up to date information, including as-builts or as-delivered modifications to be submitted within 30 days of project completion.
- 1.5. This document sets forth the basic guidelines for electronic cable tab records and document submittal. Since technology is constantly evolving, file formats and application versions listed in this document are subject to mutually agreeable change.
- 1.6. In addition to these specifications LG&E / KU has other document submittal requirements as listed below:
 - LKE_DMS_06.15 – Specifications for Electronic Submittal of Engineered Drawings
 - LKE_TL_06.15 – Specifications for Electronic Submittal of Vendor Documentation

NOTE: Not all specifications will be applicable to all projects.

2. Drawing Management System – Cable Tab Records

- 2.1. This specification provides minimum requirements on how information shall be provided electronically to LG&E / KU.
- 2.2. Unless otherwise specified in the contract or purchase order final cable records are to be submitted in electronic format on CD or DVD.



**Specification for Electronic
 Submittal of Cable Tabulation Records**

**LG&E / KU
 Generation Services**

- 2.3. In addition, electronic submissions may be requested via e-mail, and hard copies may be required.
- 2.4. Unless otherwise specified in the contract or purchase order the Owner will provide a range of LG&E/KU cable numbers to the Contractor as required for the project.
 Cable numbers shall be generated using the following format:

GH3-AN-12345

Where-

*GH3 is the 3 or 4 digit plant and unit number (0=common)
 AN is the system code (Each plant has its onset AND will be provided)
 12345 is the 5-digit next available cable number based on location AND system code. Field must have the leading zeros padded to (5) digits such that cable "432" would appear as "00432".*

Cable revisions shall start with the letter "A" and proceed through the alphabet skipping the letters "I" and "O".

- 2.5. If more than 20 records are to be submitted, the information indicated in TABLE 1 shall be provided for each cable tab number for storage into DMS. The index shall be submitted electronically in Excel or Access format.

TABLE 1 – Typical Information for Cable Tab Record Data Submission

Field Name	Character Limit	Examples
Cable Number	12	<i>The actual number of the cable as listed on the cable sheet. On new cables the number can be automatically assigned. Ex. GH4-SS-10000</i>
Location Code	3	<i>The location is the plant and generating unit for which the cable was created. Ex. GH1 - Ghent Unit 1</i>
Plant System	3	<i>An organization of similar equipment related to various portions of the plants. Ex. CH – Coal Handling</i>
Page No.	4	<i>The page number or tab that the cable information is on.</i>

**Specification for Electronic
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 Generation Services**

Field Name	Character Limit	Examples
Physical Status Code*	1	<i>The physical status code indicates the cables current status in its physical state. See chart for additional information.</i>
Service	125	<i>This is the service or function that the cable is being used for.</i>
Conductor Quantity	3	<i>The number of conductor(s) in a cable.</i>
CT From/To Equip Desc	100	<i>The equipment name and description the cable(s) runs "to" and "from".</i>
CT From/To Wiring Dwg	20	<i>The wiring drawings that the cable(s) runs "to" and "from".</i>
Cable Quantity	3	<i>The number of individual cables ran together under a single cable number.</i>
Cable Construction*	15	<i>This is an abbreviated construction description of hoe the cable is made.</i>
Conductor Size*	10	<i>The physical size of the individual wire(s) in a cable.</i>
Ground Conductor Size	10	<i>The physical size of the ground wire(s) in a cable.</i>
Cable Type*	10	<i>Is what the cable is actually being used for (i.e. power, data, control)</i>
Rated Voltage*	10	<i>The ANSI maximum voltage rating the cable(s) or individual conductor(s) can handle.</i>
Insulation Type	10	<i>The material used to insulate the individual conductors(s) of a cable.</i>
Jacket Type	10	<i>The material used to insulate the cable and its conductor(s).</i>
Cable Length	4	<i>The length of the cable "to" and "from" equipment.</i>
CT From/To Physical Dwg	20	<i>The physical drawing that the cable(s) runs "to" and "from".</i>
CT Sch Dwg	20	<i>The schematic drawing that is associated with the cable(s).</i>

**Specification for Electronic
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Field Name	Character Limit	Examples
Raceway Type*	10	<i>The material used to contain and support the cable that runs in between the "to" and "from" location.</i>
Routing	339	<i>An overall description of how the cable is ran "to" and "from".</i>
Raceway Size*	10	<i>The size of the raceway type.</i>
CT Drawing Num	20	<i>The drawing number that is on the cable tab sheet where the cable exists.</i>
BOM Item	35	<i>This is the project number or what the cable was billed to or ordered under.</i>
Comments	120	<i>A general area for any additional information.</i>

* See TABLE 2 for valid field contents

**Specification for Electronic
 Submittal of Cable Tabulation Records**

**LG&E / KU
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TABLE 2 – Valid Field Contents

Cable Construction	Cable Type	Conductor Size	Insulation & Jacket	Raceway Size	Raceway Type	Rated Voltage	Physical Status Code
C CTRL	CTRL	26 awg	EPR	1/2	EMT	45V	1 Installed
C PWR	PWR	24 awg	HYP	3/4	IMT	50V	2 Demolished
C w/gnd	INST	22 awg	N	1	RAC	150V	3 Abandoned
C w/gnd ALX	DATAKOM	20 awg	PVC	1 1/2	RMC	300V	4 Spare
C w/gnd STX	ND	18 awg	SIS	1 1/4	PVC	600V	5 TBD
C ALX		16 awg	THHN	2	PVC-80	800V	
PR		14 awg	THWN	2 1/2	SBT	900V	
PR E-TC		12 awg	XLPE	3	VBT	1KV	
PR J-TC		10 awg	CPE	3 1/2	LDT	2KV	
PR K-TC		9 awg	ETFE	4	CT	2.5KV	
PR CRC		8 awg	EPDM	4 1/2	TD	4KV	
TR		6 awg	FEP	5	ST	4.5KV	
C STX		4 awg	Glass	6	ND	5KV	
SHLD		2 awg	Nylon	4" tray		8KV	
C5		1 awg	PE	6" tray		12KV	
CX		1/0 awg	PFA	9" tray		15KV	
FO		2/0 awg	PTFE	12" tray		17KV	
ND Control		3/0 awg	TFE	18" tray		18KV	
ND DataCom		4/0 awg	TPE	24" tray		22KV	
ND Power		250 MCM	ZH	30" tray		23KV	
ND Instrument		300 MCM	B-Fiber	36" tray		25KV	
		350 MCM	CEFIR	ND		27KV	
		400 MCM	SR			35KV	
		500 MCM	ND			45KV	
		600 MCM				75KV	
		750 MCM				ND	
		1000 MCM					
		1250 MCM					
		1500 MCM					
		1750 MCM					
		2000 MCM					
		2500 MCM					
		3000 MCM					
		ND					

**Specification for Electronic
Submittal of Cable Tabulation Records**

**LG&E / KU
Generation Services**

- 2.6. Any existing cables that are modified or deleted shall be included in the index and noted as such by usage of the Physical Status Code.
- 2.7. Once the final copy is released to the Owner, the Owner will become the proprietor of the electronic record. The Owner will take full responsibility for all future modifications and their subsequent liability.
- 2.8. The Contractor shall keep a backup copy of all electronic data provided to Owner for a minimum of 1 year from the date sent to Owner.





Generation Services

Specifications for Electronic Submittal of Engineered Drawings LKE_DMS_02.16

February 2016
Rev 12

Two handwritten signatures in blue ink are located in the bottom right corner of the page. The first signature is a stylized "J" and the second is a more complex signature.

**Specification for Electronic
Submittal of Engineered Drawings**

**LG&E / KU
Generation Services**

**LG&E / KU Specifications for
Electronic Submittal of Engineered Drawings**

1.0 Introduction

- 1.1. The purpose of this document is to set forth the minimum standards for submittal of engineered drawings for all outside engineered systems or plant improvements. This document would typically be provided to Architects and Engineering firms. It is the responsibility of the Architect or Engineering Firm to ensure that each of their subcontractors who may be supplying engineering drawings receives and follow these submittal requirements.
- 1.2. LG&E / KU Generation utilizes the Drawing Management System (DMS) which works with AutoCAD and CAD viewing software to create, edit, view, and manage CAD drawings. DMS houses *drawings only* that are likely to require updating and editing. Examples include: most A/E generated drawings such as electrical schematics, wiring diagrams, P&ID, steel, concrete and piping plans/details, and general arrangement drawings. Drawing numbers are normally assigned by LG&E / KU.
- 1.3. Engineered drawings are to be submitted to the LG&E / KU project manager per these specifications and are to include a formal transmittal.
- 1.4. Final documentation shall include the most recent revisions and up to date information, as-builts or as-delivered modifications to be submitted within 30 days of project completion.
- 1.5. This document sets forth the basic guidelines for electronic drawing/document submittal. Since technology is constantly evolving, file formats and application versions listed in this document are subject to mutually agreeable change.
- 1.6. In addition to these specifications LG&E / KU has other document submittal requirements as listed below:
 - LKE_CT_02.16 – Specifications for Electronic Submittal of Cable Tabulation Records
 - LKE_TL_02.16 – Specifications for Electronic Submittal of Vendor Documentation

NOTE: Not all specifications will be applicable to all projects.

2.0 Drawing Management System - CAD drawings

2.1. General

Specification for Electronic Submittal of Engineered Drawings

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- 2.1.1. This specification provides minimum requirements on how CAD drawings shall be provided to the Owner.
- 2.1.2. There are no defined CAD standards that the Owner requires the A/E to follow, except that a North Arrow be placed on all Architectural, Civil, Mechanical and Structural drawings. It is up to the Contractor to use their standards as long as it complies with the other requirements of this document.
- 2.1.3. Once the final copy is released to the Owner, the Owner will become the proprietor of the electronic drawing. The Owner will take full responsibility for all future modifications and subsequent liability thereof.
- 2.1.4. Unless otherwise specified in the contract or purchase order, only the final copy of the drawing shall be provided to the Owner for electronic storage. The final copy shall include all as-built or as-delivered modifications.
- 2.1.5. All new CAD drawings shall be vector based unless a copy of a waiver to this requirement for the specific drawing(s) is provided with the transmittal.
- 2.1.6. For existing plant prints requiring modification for work not yet completed any modification shall be clouded/bubbled and marked with the letter of the Revision. As-builts or field revisions shall NOT be clouded/bubbled.
- 2.1.7. Unless otherwise specified in the contract or purchase order existing plant prints requiring modification shall be handled one of the following ways (also see Section 2.2.8 that describes revision sequencing):
 1. Existing plant prints will be redlined and submitted electronically in color TIFF/JPG or *PDF format as a sketch (SK) drawing. The drawing number shall include the letters SK and the existing plant drawing number. An SK drawing can be used to identify a drawing to be voided.

 LG&E/KU will be responsible for incorporating these changes into the existing drawing. Black and white TIFF or *PDF redlined drawings may be submitted if redlined hard copies are also provided if a copy of a waiver to this requirement for the specific drawing(s) is provided with the transmittal.
 2. Existing plant prints may be requested in .DWG format for redlines to be electronically corrected and submitted in a .DWG format as a sketch (SK) drawing. The drawing number shall include the letters SK and the existing plant drawing number. An SK drawing can be used to identify a drawing to be voided.

For contractor modifications to existing plant prints, the contractor shall submit the drawings back to LGE/KU in accordance with Section 2.4.

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Specification for Electronic Submittal of Engineered Drawings

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- 2.1.8. The Owner shall provide to the Contractor an AutoCAD version of all LG&E / KU drawing title blocks as required. The Owner shall also provide hard copy, TIFF or *PDF images of existing plant drawings for redlining unless otherwise outlined in the contract.
- 2.1.9. The Owner reserves the right to request sample AutoCAD drawings to test our ability to access and properly view the drawing information within our applications.
- 2.1.10. Upon project completion final paper copies of as-built drawings shall be provided to the project manager or designee unless a copy of a waiver to this requirement for the specific drawing(s) is provided with the transmittal. The number of paper drawing sets required shall be outlined in the contract.

**PDF Format: All PDF documents submitted must be PDF/A-1a or PDF/A-1b compliant. See ISO Spec 19005-1:2005 Document Management - Electronic document file format for long term preservation - Part 1 Reference: <http://en.wikipedia.org/wiki/PDF/A>*

2.2. Vector Based CAD Drawings

- 2.2.1. Drawings shall be drawn in AutoCAD 2008 version or later but must be saved and turned over to the owner in AutoCAD 2007 file format.
- 2.2.2. When using other CAD applications and performing conversions to AutoCAD the vendor shall ensure that drawing attributes, block names, line types, line weights, font styles, dimension styles, etc. are properly converted. Ultimately the converted file, when plotted, should look identical to the version created in the native CAD format. The Owner may request electronic copies of converted files to review the conversion quality from native format to AutoCAD.
- 2.2.3. The drawings shall be bordered by a title block/drawing sheet provided by the owner. Drawing sizes Arch A thru E are available based on the normal sizes used by the specific plants.
- 2.2.3.1. The drawing sheet shall be inserted as a block retaining all of the title block attributes and layers. **Do not explode or modify the title block or change the title block name, layer names, or modify the attribute tag names in the Owner supplied title block.**
- 2.2.3.2. The drawing sheet shall be inserted at the 0,0 coordinate in layout 1 paper space view such that the lower left hand corner of the sheet is at 0,0.
- 2.2.3.3. The title block attributes shall be filled out. See Table 1 for typical title block attributes and Figure 1 for a sample title block. Other LG&E / KU title blocks may be used depending on plant locations and drawing size.

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- 2.2.3.4. The Contractor shall provide their company name in the Originally Designed by attribute in the title block. In addition, they may insert their own title block, company logo, and/or PE stamp to the immediate left of the Owner’s title block **as a separate AutoCAD block**. This information shall not stand taller than the Owner’s title block. See Figure 1.
- 2.2.4. All non-dimensioned drawings shall be drawn at a 1 to 1 scale. These drawings may include electrical schematics, wiring, and connection diagrams, mechanical flow diagrams, and logic diagrams.
- 2.2.5. The Contractor will provide the Owner an estimated range of drawing numbers for each of the major disciplines (Arch, Civil, Structural, Mech, Elect) and by plant unit or common. The Owner will provide a range of Unit-specific LG&E / KU drawing numbers to the Contractor as required based on this information.
- 2.2.6. Drawing numbers shall use the following format:
 GH3-E-12345-4321 or SK-GH3-E-12345-4321
Where-
GH3 is the 3 or 4 digit plant and unit number (0=common)
SK used only if identifying a redlined existing plant drawing
E is the engineering discipline (E-Electrical, C-Civil, M-Mechanical, A-Architectural, S-Structural)
12345 is the 5-digit next available drawing number based on location AND discipline. Field must have the leading zeros padded to (5) digits such that drawing “432” would appear as “00432”
4321 is an optional Contractor-assigned 4-digit alphanumeric describing a specific page or sheet number of the drawing. This field is optional but if used it shall be padded to (4) characters.
- 2.2.7. The Contractor may include their own drawing number in their title block (if included) but all internal and external drawing references shall utilize the Owner’s assigned drawing number.
- 2.2.8. LG&E / KU drawing number revisions shall start with the letter “A” and proceed through the alphabet skipping the letters “I” and “O”. Numbers are not to be used for LG&E / KU revisions unless used for preliminary drawings for review not for final submittal. Please use the following guidelines:
 - 1. First preliminary drawings issued shall be labeled as Rev 1.
 - 2. Subsequent drawing issued shall use revision 2, 3, 4 until drawing is Issued for Construction (IFC).
 - 3. First IFC drawing shall be issued with a blank in the Revision designation.
 - 4. Subsequent revisions after IFC shall be A, B, C, D, etc.

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5. Final Submittal drawings shall have the last revision letter used after IFC.

Also see Sections 2.1.6 and 2.1.7 that describes revisions for work not yet completed and modifications to existing plant prints.

2.3. Raster (or hybrid) Based CAD Drawings

- 2.3.1. Where required, hybrid CAD techniques may be employed to modify existing plant drawings. Do not use AutoCAD's *WIPEOUT* command to mask raster images. The raster images shall be modified using raster editing software such as Raster Design 2008 as provided by AutoDesk.
- 2.3.2. Raster images shall be provided in a GP4 (CALs Group 4, Type 1) format. Other formats may be acceptable upon review with the LG&E / KU.
- 2.3.3. A sample drawing (containing as a minimum both a DWG and a GP4 file) shall be provided to test LG&E / KU's ability to access the hybrid drawing information.
- 2.3.4. All raster images shall be scanned at a minimum 200 DPI resolution. Higher resolutions shall be used if the drawing detail or quality warrants it.
- 2.3.5. Scanning shall be by the Contractor or by the Owner as outlined in the specific contract. The original raster title block shall be removed. The standard Owner's title block will be inserted as per paragraph 2.2.3.2. The scanned image shall be visible in a viewport.
- 2.3.6. If specified in the contract vectorization of raster or hybrid drawings may be required prior to final submission. Contractor and Owner will agree upon drawings to be vectorized.
- 2.3.7. ALL OTHER ITEMS IN SECTION 2.2 APPLY.

2.4. CAD Drawing Submittal

- 2.4.1. Final AutoCAD drawings and raster images (in the case of Hybrid drawings) shall be submitted to Owner on CD or DVD. The file names shall match the LG&E / KU drawing numbers
- 2.4.2. Back-up TIFF or *PDF images of the drawings as produced from the native CAD application shall be provided on the CD. TIFF or *PDF images shall include the signed PE stamp if applicable.
- 2.4.3. Drawings may be created using x-references and/or links to other drawings but when the final drawing is submitted to Owner, all external references shall be permanently bound into the drawing such that there is only one DWG file per



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drawing. Likewise if there are multiple insertions of raster images (in the case of Hybrid drawings) they shall be merged into a single raster image file with the same name as the DWG file except using the file extension of one of the approved raster formats.

- 2.4.4. Each drawing shall be submitted under a different file name. For example if three drawings are created using three different paper space views of the same model space, it shall be duplicated three times and only the view representative of the individual drawing shall be saved in the final file as layout 1 in paper space. Any extraneous drawing entities in model space not pertaining to the drawing shall be deleted.
- 2.4.5. Standard AutoCAD text fonts should be used. If any non-standard AutoCAD fonts, textures, dimension styles, plot styles, etc. are used within the drawing, a copy shall be provided when the drawings are submitted to Owner.
- 2.4.6. If drawings are created with line weights based on Color Tables, the proper CTB file shall also be provided to the Owner. CTB filenames are to be unique and should include the vendor's initials and a date.
- 2.4.7. Non-standard support files submitted according to 2.4.5 and 2.4.6 shall be given unique filenames containing originating company's name or initials.
- 2.4.8. If drawings are created based on layer/level dependent line weights, a listing of those settings shall be provided to the Owner. (NOTE: Line weights based on CTB tables is preferred).
- 2.4.9. The Contractor shall keep a backup copy of all electronic data provided to Owner for a minimum of 1 year from the date sent to Owner.
- 2.4.10. All drawings and media provided to Owner shall be fully manifested. If 20 or more drawings are to be submitted an index shall be provided electronically in Excel or Access format which includes, as a minimum, the information contained in TABLE 1 at the end of the Specification.



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TABLE 1 – Typical Drawing Attribute Information for DMS Submission


Field Name	Character Limit	Examples
Project	8	<i>As agreed upon in the contract</i>
Drawing Number	20	<i>As agreed upon in the contract</i>
Alternate Drawing Number	20	Vendor’s internal drawing number (optional)
Revision	1	A or B or C... (skipping I and O)
Original creation date	8	12/01/00
Latest revision date	8	12/31/00
Title	96	
Location	4	MC4 or TC1 or GH0 (0=common systems)
Engineering Discipline	1	E=electrical, C=civil, M=mechanical, A=architectural, S=structural
Drawing Type	Any	wiring, schematic, flow, logic, site plan, foundation, piping, details, steel, etc.
Drawing size	1	D or E, etc.
Scale	Any	¼”=1’, none, as noted, etc.
CAD Filename	Any	File name shall match the LG&E/KU drawing number and shall not contain any spaces.
Release Reason	Any	Construction, Approval, Reference, etc


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Revisions	
A	Project: A96-000
THIS IS WHERE THE REVISIONS WILL BE PLACED ON ALL DWGS.	
Dwn: Drafter	15SEP96
Chkd: Checker	15SEP96
Appd: Approver	15SEP96

*For LG&E Title Blocks. Vendor to recreate for revision information.

Vendor's Title Block can be located in this area	Location and Unit: Mill Creek		 Generation Services	Drawn: <i>CEJ</i>
	Scale: None	Contract No: n/a		Checked: <i>CEJ</i>
	Engineering discipline: Mechanical	Drawing type:	LOUISVILLE GAS & ELECTRIC COMPANY A SUBSIDIARY OF LO&ENERGY.	Approved: <i>CEJ</i>
	Title First line of Title Second line of Title Third line of Title			Released for: HID Alternate Drawing No:
7	Originator: Engineering Co	Job or Project No: Project No	Drawing No: MC3-E-12345	Rev: B <small>DMS Version 2.0</small>

Vendor's Title Block can be located in this area	SCALE	Title First line of Title Second line of Title Third line of Title	 Kentucky Utilities Company <small>A Subsidiary of LG&ENERGY</small>	Drawing No: GH3-E-12345	Rev: B
	None				
	PROJECT NUMBER				
	123456				
Location and Unit: KENTUCKY UTILITIES GENERATING STATION		<small>DMS Version 2.0</small>			

**Figure 1
 Sample Title Block
 (Other versions and formats are available)**

Ja
 APR



Generation Services

**Specifications for
Electronic Submittal of
Vendor Documentation
LKE_TL_02.16**

**February 2016
Rev 12**

Jc
AKR

Specification for Electronic Submittal of Vendor Documentation

LG&E / KU
Generation Services

LG&E / KU Specifications for Electronic Submittal of Vendor Documentation

1.0 Introduction

- 1.1. The purpose of this document is to set forth the minimum standards for submittal of vendor documentation for equipment or package system purchases. This document would typically be provided to Equipment Suppliers.
 - 1.2. LG&E / KU Generation utilizes Quest as a repository that provides secure storage, backup and recovery for all electronic files, document images, and various record types that are not likely to change. Examples: Vendor drawings, instruction manuals, correspondence, and all other vendor documentation. Drawing and document numbers are assigned by the supplier.
 - 1.3. Documents from sub-vendors shall be included and provided in a similar fashion to those of the primary vendor.
 - 1.4. Project records are to be submitted to the LG&E / KU project manager per this specification and shall include a formal transmittal.
 - 1.5. Final documentation shall include the most recent revisions and up to date information, as-builts or as-delivered modifications to be submitted within 30 days of project completion.
 - 1.6. This document sets forth the basic guidelines for electronic drawing/document submittal. Since technology is constantly evolving, file formats and application versions listed in this document are subject to mutually agreeable change.
 - 1.7. In addition to these specifications LG&E / KU has other document submittal requirements as listed below:
 - LKE_DMS_02.16 – Specifications for Electronic Submittal of Engineered Drawings
 - LKE_CT_02.16 – Specifications for Electronic Submittal of Cable tabulation Records
- NOTE: Not all specifications will be applicable to all projects.
- 1.8. The following vendor drawings listed below need to follow the guidelines provided in Exhibit X Appendix D (Specifications for Electronic Submittal of Engineered Drawings):
 - General Arrangements and Outline Drawings for a building or entire facility.

Specification for Electronic Submittal of Vendor Documentation

LG&E / KU Generation Services

- Flow Diagrams
- Process and Instrument Diagrams
- Electrical One line Diagrams
- Electrical Schematic and Wiring Diagrams
- Electrical Switchgear and MCC drawings
- Structural Steel Drawings
- Piping Plan/Detail Drawings

2.0 Quest – Vendor Drawings and other documents

- 2.1. This specification provides minimum requirements on how documents shall be provided electronically to LG&E / KU.
- 2.2. Unless otherwise specified in the contract or purchase order, final documentation, drawings, specifications, and manuals are to be submitted in electronic format on CD or DVD. Documents shall be separated into Document Types before compiling onto CD or DVD for electronic submittal.
- 2.3. In addition, electronic submissions may be requested via e-mail, and hard copies may be required.
- 2.4. Letter/Legal size documents are to be submitted in Adobe *PDF format.
- 2.5. Drawings created by CAD software shall be submitted in AutoCAD DWG format or *PDF images. Non-CAD drawings shall be submitted in *PDF formats.
- 2.6. Each drawing submitted in CAD or *PDF format shall be a separate file with a unique filename unless the drawing is only intended to be submitted as a page in a larger document or manual.
- 2.7. Photographs, aerial photos or maps etc. shall be submitted in JPG format.
- 2.8. If the number of records being submitted exceeds 20 records, an index (as it applies per type of record being submitted) shall be provided for each vendor or sub-vendor drawing and other documentation for storage into Quest Drawings are to be indexed individually. Other documentation, such as project files, can be batched by the Document Type and indexed as a group. The index shall be submitted electronically in Excel or Access format which includes, as a minimum, the information contained in TABLE 1 at the end of the Specification.

**Specification for Electronic
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3.0 Quest- Manuals and Reports

- 3.1. Technical manuals, parts catalogs and equipment specifications originating from an equipment manufacturer or distributor shall be submitted in *PDF format.
- 3.2. Power Plant system manuals which contain a compilation of customized technical specs or equipment manuals from various sources must be provided in a sectional format with a detailed table of contents. System manuals may be submitted in a bound hardcopy or *PDF format. Hard copies shall be submitted with duplicate *PDF files. The *PDF shall closely mimic the sectional hardcopy style with a table of contents referencing each section. If the entire manual is greater than 200 pages, then each section must be provided as a separate *PDF file.
- 3.3. Technical and Regulatory Reports including Outage Reports must be submitted in *PDF format, rendered from the original document when possible, otherwise PDF's containing scanned images of the report(s) are acceptable. Desktop services may be able to provide you with the necessary *PDF print driver required to output compound *PDF document from your software application.
- 3.4. All manuals and reports will be provided to LG&E / KU by filling out spreadsheets provided by LG&E / KU following the format laid out in TABLE 2 at the end of the Specification.

**PDF Format: All PDF documents submitted must be PDF/A-1a or PDF/A-1b compliant. See ISO Spec 19005-1:2005 Document Management - Electronic document file format for long term preservation - Part 1 Reference: <http://en.wikipedia.org/wiki/PDF/A>*



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TABLE 1 – Typical Information for Quest Data Submission

Field Name	Character Limit	Examples
Document ID	30	<i>ID associated with document</i>
Project Number	25	<i>Project Number associated with document</i>
Manufacturer	100	General Electric, Fluor, Diamond Power
Drawing Number	50	Manufacturer's drawing number
Title	100	Drawing or Record Title, Description
Plant	32	Brown, Trimble County, Cane Run
Unit	32	1, 2, 3, 4, etc.
Comments	100	Additional information pertaining to document
Document Type	32	Manual, Report, Specification
Document Date	10	MM/DD/YYYY (Format consistency important)

**Specification for Electronic
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TABLE 2 – Typical information for Manuals and Reports

Data Entry Instructions			
Field Name	Description / Comments	Type / Length	Values / Examples
Media Label	The name of the media the document is contained on. Please make sure to uniquely identify each media volume delivered, use black permanent marker to label media.	Char / 20	Project Name – IOM-001
File Path	Enter the relative path of the file being indexed without drive a letter. (Path relative to the root of the source media, CD/DVD etc...)	Char / 50	\\dir1\dir2\filename.pdf
Record Type	Manual for all IOM Manuals, sections or chapters contained in a manual. Report for all inspection or reports on specific plant equipment and or systems that are not specifically incorporated with an IOM Manual.	Pick list	MANUAL, REPORT
Document Id	ID associated with document	Char / 30	Contract #, PO #, Spec ID
Project No	LG&E or KU designated project number	Char / 25	LG&E / KU Project Number
Plant	Name of plant associated with project	Pick list	Brown, Trimble County, Cane Run
Unit	Plant unit associated with project	Pick list	1,2,3,4
Title	Manuals and reports description	Char/100	Coal Conveyor
Volume	Volume Id of Manual or Report	Numeric / 32	1, 2, 3 etc
Total Number of Volumes in Set	Volume set Id of Manual or Report	Numeric / 32	1, 2, 3 etc
Manufacturer	Name of manufacturer or supplier of equipment	Char / 100	General Electric
Document Date	Document date or Report of report	Char / 10	MM/DD/YYYY
Comments	Data entry comments (not filed)	Char / 150	Misc. comments

Exhibit X Appendix F

Trimble County Component Numbering (2/20/15)

1. System Identifiers (applies to all commodities)

System	Description
ABB	Auxiliary Boiler Blowdown
AC	Auxiliary Cooling
ACA	Activated Carbon Injection (PAC)
ACF	Auxiliary Boiler Chemical Feed
AFR	Auxiliary Boiler Fuel Oil Return
AFS	Auxiliary Boiler Supply
AFW	Auxiliary Boiler Feedwater
AHB	Bottom Ash
AMU	Auxiliary Boiler Make-up Water
AR	Air Removal
AS	Auxiliary Boiler Steam Supply
ASC	Auxiliary Boiler Steam Condensate
AT	Attemperator Spray
AW	Station Ash Water
BFD	Feedwater (Discharge, recirc, warm-up)
BFR	Boiler Feed Recirculation
BFS	Boiler Feed Suction, water coil air heater
BFT	Boiler Feed Pump Turbine
BFW	Boiler Feed Warm-up
BLB	Boiler Blow-off Fill and Drain
BLC	Man and Reheat Steam Temporary Blow-out
BLS	Steam Generator, Water/Steam Side
BLV	Unit Ventilation
BMS	Burner Management
CA	Construction Air
CB	Combustion Air
CC	Closed Cooling
CCR	Coal Combustion Residuals
CD	Condensate
CEM	CEMS, Noise Monitoring
CH	Station Coal Handling
CHE	Cranes, Hoists, Elevators
CHW	Service Building, Chilled Water (Supply / Return)
CI	Chemical Injection
CL	Arrangement of Linkage between Equipment Control Devices
CP	Condensate Polisher
CR	Cold Reheat

System	Description
CW	Circulating Water (Cooling tower, condenser, supply / return)
CW	Cooling Tower Blowdown
DCS	DCS
DG	Diesel Generator
DR	Deaerator Drain
DSI	Dry Sorbent Injection (aka Hydrated Lime Injection)
E14	14 kV (13.8) System
E40	4 kV (4.16) System
E48	480V System
E70	7 kV (6.9) System
ECP	Cathodic Protection
ED1	125V DC Power
ED2	250 VDC System
EGB	Main Generator System
EHT	Heat Tracing
ELG	Grounding and Lightning Protection
ELP	Lighting Power
EM	Metering & Protection
EPA	Public Address System
ES	Extraction Steam
ESC	Security
EUP	120V UPS System
EWR	Welding Receptacles
FA	Boiler Fly Ash discharge
FC	Fuel Coal (inplant) Main Fuel, Coal Silo Ventilation
FL	Flue Gas
FO	Station Fuel Oil
FOI	Ignition Oil
FP	Station Fire Protection
FP	Unit Fire Protection
GS	Gland Steam
HA	Station and House Air
HD	Heater Drains
HL	Hydrated Lime Injection (also see DSI)
HOV	Heater Operating Vents
HR	Hot Reheat
HV	Miscellaneous Gas (H ₂ , CO ₂)
HW	Service Building, hot water (supply / return)
IA	Instrument Air
LC	Level Controls, Alarms and gage glass
MPS	Station Vacuum Cleaning
MPV	Vacuum Cleaning Unit
MS	Main Steam, steam supply to deaerator
MST	Steam Turbine
MU	Condensate Make-up (Unit)
MV	Station Condensate Make-up Treatment
POC	Preoperational Cleaning

System	Description
PW	Potable Water
QFF	Pulse Jet Fabric Filter
QPR	Dry ESP
QRW	Wet FGD Reclaim Water System
QSD	Wet FGD
QV	AQCS Ventilation System
QWP	Wet ESP
RD	Roof Drains / Plumbing
RS	SDRS Reactant Supply
SB	Sootblowing
SCR	SCR System / Ammonia
SD	Sump Pump Discharge
SF	Station Softened Water
SLO	Station Lube Oil
SP	Sump Pump Bedplate, Equipment & Misc. Floor Drains
SS	Sampling (Cycle Water Purity)
ST	Sewage Treatment
SV	Equipment Safety Valve Vents (incl. Boiler Vents)
SW	Service Water
SWA	Ash Water (Unit)
TBO	Lube Oil
TCO	Steam Turbine Hydraulic Control Oil
TDR	Turbine Cycle Drains
TOP	Turbine Oil Cleansing
TSO	Hydrogen Seal Oil
UHR	Unit Heating Water Return
UHS	Unit Heating Water Supply
WT	Cooling Tower Water Treatment
WW	Well Water

2. Mechanical Numbering Convention

Example:	2	-	TBO	-	MP	-	001		A
	--		--		--		---		--
Field Location:	A		B		C		D		E

Show on drawings as 2-TBO-MP-001A with written description of 2A Lube Oil Pump.

A - Unit Numbers (applies to Equipment, lines, valves, piping specialties)

- 1 - Unit 1
- 2 - Unit 2
- 0 - Common

B - System Identifiers (applies to Equipment, lines, valves, piping specialties)

Refer to system list in Section 1 of this Appendix.

C - Commodity Codes (Equipment & piping specialties)

System	Description
MF	Fans, Blowers
MB	Boilers, Burners
MC	Compressors, Vacuum Pumps
MD	Dampers, Ducts
ME	Heat Exchangers, Cooling Towers, Condensers, Heaters, Air Coils, Chillers
MM	Pulverizers, Mills, Crushers, Separators
MG	Generators
MH	Feeders, Handling Devices (e.g. conveyors), Elevators
MJ	Hoists
MA	Air Filters, including fabric filters, absorbers, and electrostatic precipitators
ML	Liquid-Solid Separation: screens, vacuum filters, hydrocyclones
MP	Pumps
MS	Tanks, Bins, Silos
MT	Turbines, Couplings, Gear Reducers, Engines
MV	Air Dryers, Pressure Vessels, Catalysts
MX	Mixers, Agitators
MY	“Skids” This refers to packaged or pre-assembled collections of individual components which are shipped and installed as a single unit

[** all individual commodities still get numbered individually per this appendix **]

PY Strainer, Trap, Hose, Expansion Joint, Filter, Silencer (in-line piping components other than valves or “specialties”)

FO Flow restriction orifice (vs. FE/flow measurement element)

C – Commodity Codes (Valves)

MOV Remote - Actuated Shutoff (on – off) Valves (motor-operated)

PSV Relief and Safety Valves

CV Remote-Actuated Shutoff (on – off) Valves (air- or hydraulic- operated); Control Valves

V Other (manual) valves

C – Commodity Code (Lines)

L Line

D - Sequence Numbers (applies to Equipment, lines, piping specialties)

001 through 999. Number from North (001) to South (999), or from East (001) to West (999), or from top (001) to bottom (999). In combination, prioritize numbering from top to bottom first, then from north to south, and from east to west last.

- Leading zeros are to be shown on drawings.
- Within a specific system, use the same sequence number for identical commodities (and only for identical commodities). If identical commodities occur in common lines/systems or within unitized trains (e.g., 2 x 50% boiler feed pumps in each unitized system, 3 x 50% compressors in a common system), each identical commodity should get the same three-digit sequence number. Do not re-use the same sequence number for unitized commodities if already used for common commodities and vice versa. A suffix (Field E) is required in all cases where the same sequence is used for a given unit/train to differentiate between the identical commodities.
- Except for similar system configurations between Unit 1 and Unit 2 commodities, do not use the same sequence number for another commodity within a specific system (i.e., if sequence 001 is used in Unit 1 and Unit 2 instrument air lines, do not use 001 for a common plant air line, and if sequence 005 is used for a commodity in Unit 1, but a similar commodity does not appear in the Unit 2, do not use 005 for any other Unit 2 commodity).
- System changes should occur only at valves. (Unit changes may occur at locations other than valves depending upon the physical configuration.)
- Large bore lines (2.5" and larger) and small bore lines (2" and smaller) should not be numbered using different blocks of sequence numbers to avoid changing a line number if it is later determined that a 2" line needs to be 2.5" and vice versa.
- Assign a new line sequence number for every change in condition [i.e., for every change in line size, material, service pressure, design pressure, service temperature, design temperature, inside vs. outside location, heat tracing vs. no heat tracing, underground vs. above ground location (but not also at the plane of the building wall for underground piping)].

D – Sequence Number (valves only)

	Sequence No.	Example
Large and small bore manual valves:	001 – 499	2-MS-V-123
MOVs:	001 – 499	2-GS-MOV-003
Air- or Hydraulic-operated On-off Valves	001 – 499	2-CD-CV-005
Instrument Root Valves (1” unless otherwise noted):	600 – 699	0-WT-V-600
Vents (1” unless otherwise noted):	700 – 799	2-MS-V-701
Drains (1” unless otherwise noted):	800 – 899	2-MS-V-801
PSVs:	900 – 999	2-CR-PSV-900

- If supplier and Owner provide components in one “system” then the numbering must be coordinated (shared). For example, for STG valves in the SLO and HV systems, the following split was agreed. This should be the starting point for other shared Boiler or STG systems as well. If the available block of numbers “runs out,” contact Owner.

	Sequence No.	Example
Large and small bore manual valves:	001 – 399	400 – 499
MOVs:	001 – 399	400 – 499
Air- or Hydraulic-operated On-off Valves	001 – 399	400 – 499
Instrument Root Valves (1” unless otherwise noted):	600 – 649	650 – 699
Vents (1” unless otherwise noted):	700 – 749	750 – 799
Drains (1” unless otherwise noted):	800 – 849	850 – 899
PSVs:	900 – 949	950 – 999

- Leading zeros are to be shown on drawings.
- Valves in Unit 1 and Unit 2 with the same configuration shall get the same valve sequence number. If Unit 1 and Unit 2 valves do not have the same configuration, they are assigned unique sequence numbers.
- Except for same configuration Unit 1 and Unit 2 valves, do not use the same sequence number for another valve (i.e., if sequence V001 is used for valves in unitized lines, do not use V001 for a valve in a common line, and if sequence V005 is used for a valve in a unitized line in the first unit, but does not appear in the second unit, do not use V005 for any valve in the second unit or in a common line).
- Valves in large bore lines and small bore lines should not be numbered using different blocks of sequence numbers to avoid changing a valve number if it is later determined that a 2” line needs to be 2.5” and vice versa.

- Valves of a system other than the primary system on the P&ID shall include the system identifier on the P&ID.

E - Suffix (applies to Equipment, lines, valves, piping specialties)

- A-Z, except I and O. Assign letters from North (A) to South (Z) or from East (A) to West (Z), or from top (A) to bottom (Z). In combination, prioritize numbering from top to bottom first, then from north to south, and from east to west last.
- Use only when there is redundant counterpart, that is, to differentiate identical components used in identical services.
- Do not use suffix if Equipment has no redundant counterpart.
- Do not use A, B, C, etc. suffix for lines.
- Lines get additional line “class” and NPS size designation added in two more fields (see examples).
- Avoid using suffix for manual valves, if possible.

F - Written Description (applies to Equipment, only)

- The description is composed of a two-character field for Unit (i.e., 1 for Unit 1, 2 for Unit 2, and blank for Unit 0) and Suffix (i.e., A, B, C, etc.) followed by the Equipment identification.

G - Examples

Equipment (show entire number and description on P&IDs)

- 1 x 100% pump in a common unit system:
0-SW-MP-002 (Service Water Pump)
- 2 x 50% tanks in a common unit system:
0-CD-MS-001A ('A' Condensate Storage Tank)
0-CD-MS-001B ('B' Condensate Storage Tank)
- 3 x 33% compressors in a common unit system:
0-IA-MC-001A ('A' Instrument Air Compressor)
0-IA-MC-001B ('B' Instrument Air Compressor)
0-IA-MC-001C ('C' Instrument Air Compressor)
- 1 x 100% pump in each of two units:
1-CD-MP-001 (1 Condensate Pump)
2-CD-MP-001 (2 Condensate Pump)

- 2 x 100%/train pumps in each of two units:
 - 1-AC-MP-001A (1A Auxiliary Cooling Water Pump)
 - 1-AC-MP-001B (1B Auxiliary Cooling Water Pump)
 - 2-AC-MP-001A (2A Auxiliary Cooling Water Pump)
 - 2-AC-MP-001B (2B Auxiliary Cooling Water Pump)

Valves - see section D (valves) above.
(There is no need to display unit and system fields for each valve on P&IDs.)

In-Line Piping Components Other than Valves
(There is no need to display unit and system fields for each component on P&IDs.)

- Trap in a common line:
0-SW-PY-031
- Exp. joint for 2 x 100% pumps in a common system:
0-SW-PY-001A
0-SW-PY-001B
- Strainers for 2 x 100%/train pumps in each unit:
1-AC-PY-002A
1-AC-PY-002B
2-AC-PY-002A
2-AC-PY-002B

Lines (show entire number on P&IDs)

- Identical lines in two units:
1-MS-L001-9NH -20" and
2-MS-L001-9NH -20"
- Common plant line:
0-CW-L005-QEJ -132"

Example:	0	- CW	- L005	- QEJ	- 132"
	--	--	--	--	--
Field Location	A	B	C	D	E

A - Unit Numbers

- 1 - Unit 1
- 2 - Unit 2
- 0 - Common

B - System Identifiers

Refer to system list in section 1 of this Appendix.

C - Line Sequence Number

D - Line Class

- 1st character: Material Type
- 2nd character: Rating
- 3rd character: Design Code

See Line Class “Code Breaker” tables for definition of 1st, 2nd, and 3rd characters.

E - Pipe Size (NPS and inches)

Line Class “Code Breaker”			
1st Char	Material Type	1st Char	Material Type
1	Cast Iron-High Silicon	G	Carbon Steel – Galvanized
2	Carbon Steel – Cement Lined	I	Cast Iron
3	Polyvinyl Chloride (PVC)	J	Ductile Iron – Cement Lined
4	Alloy Steel (1-1/4 Cr) P11	K	Alloy Steel (2-1/4 Cr) P22
8	Carbon Steel – Epoxy Lined	L	Carbon Steel – Low Temperature
9	Alloy Steel (9 Cr – 1 Mo – V) P91	P	Chlorinated Polyvinyl Chloride
B	Copper/Copper Alloy	Q	Concrete
C	Carbon Steel	R	Carbon Steel – Rubber Lined
D	Ductile Iron	S	Stainless Steel
E	High Density Polyethylene (HDPE)	U	Alloy 20
F	Fiberglass		

2nd Cha	Rating	2nd Char	Rating
1	Class 150 (ASME B16.5, B16.24)	E	Class 125 (ASME B16.1)
2	Class 250 (ASME B16.1)	F	175 psi (UL Rating)
3	Class 300 (ASME B16.5)	G	200 psi (Manufacturer’s Rating)
4	Class 400 (ASME B16.5)	J	Class 1500 (B16.5)
6	Class 600 (ASME B16.5)	L	Class 2500 (B16.5)
7	Victaulic Pressfit Rating	N	Class 4500 (B16.5)
9	Class 900 (ASME B16.5)	S	As Specified on Class Sheet

3rd Char	Code	3rd Char	Code
1	ASME B31.1 (special)	F	NFPA
3	ASME B31.1 (special)	H	ASME Section I, Power Boilers
4	ASME B31.1, Power Piping Code	J	AWWA
5	ASME Section I, Power Boilers	M	ASME B31.1, Power Piping Code
6	ASME B31.1, Power Piping Code	N	ASME B31.1, Power Piping Code
7	ASME Section I, Power Boilers	Q	Plumbing Code
8	ASME B31.1, Power Piping Code	W	ASME B31.1, Power Piping Code
9	ASME Section I, Power Boilers	X	ASME B31.1, Power Piping Code
D	ASME B31.1, Power Piping Code	Y	ASME B31.1, Power Piping Code
E	ASME B31.3, Process Piping Code	Z	(Owner Purchased)

3. Instrument & Control Numbering Convention

This standardized approach is a modular one based upon ISA 5.1 and standard industry practices.

3.1 Purpose

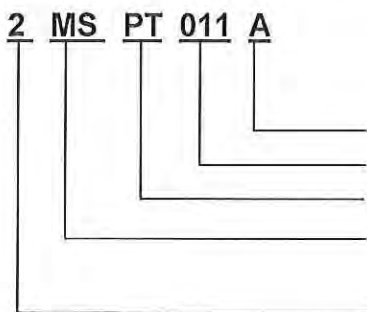
The purpose of this numbering convention is to establish a uniform means of identification for instruments and control equipment. This document guides the depiction of the “visible label” of a standard instrument. Further it outlines a means for numbering miscellaneous control system items that are normally not listed as instruments or equipment items but otherwise need identification.

This design guide is generally not intended to apply to electro-mechanical components; e.g. control relays, refer to IEEE 315 (ANSI Y32.2) nor to electrical components; e.g. as motor starters, switch gear, space heaters, etc.

3.2 Instrument Identification

All instruments including local pressure and temperature gauges should have a unique instrument identification number. Instrument tag numbers shall be assigned to separately shipped items or where design or construction activities require an individual reference; e.g. wire termination points. Otherwise, instrument assemblies that are shipped and installed as complete units shall be identified with a single tag number.

The instrument tag number consists of several elements: Unit Number, System Identifier, Function Code, Sequence Number, and Suffix.



- e. Suffix (When Needed)
- d. Sequence Number
- c. Function Code
- b. System Identifier
- a. Unit Number

a. Unit Number

- 1 - Unit 1
- 2 - Unit 2
- 0 - Common

b. System Identifier

Process sensing instruments are assigned System Identifier Codes according to the process system to which they are connected. The same system code and

sequence number is included in all other instruments connected to the sensing instrument to form an instrument measurement or control loop. The loop association does not always determine the control valve system locator code. Though, it is usually the same its piping network defines the system locator code. Lastly, some instruments may not be related to any functional operating system but are facility related; i.e., ambient temperature that is part of a HVAC system. These instruments shall be identified by the system using the information or by an otherwise appropriate facility code.

See Systems Identifiers in Section 1.

c. Function Code

Select from the list below.

- AE Analytical Element
- ANN Annunciator
- AP Analytical Test Point
- AS Analytical Switch
- ASD Analog Special Device
- AT Analytical Transmitter
- ATU Analog Trip Unit
- BA Base Number Annunciator
- BC Base Number Computer
- BI Base Number Indicator
- BR Base Number Recorder
- CAB Cabinet
- CD Control Drive
- CRT Cathode Ray Tube
- CS Control Switch
- CV Control Valve
- DE Density Element
- DT Density Transmitter
- E/H Electrical / Hydraulic Converter
- E/I Voltage / Current Converter
- E/P Electric / Pneumatic Converter
- FE Flow Element
- FI Flow Indicator
- FP Flow Test Point
- FS Flow Switch
- FT Flow Transmitter
- HS Hand Switch
- I Indicator (control panel)
- IL Indicating Light
- LC Level Controller
- LE Level Element
- LI Level Indicator

LS	Level Switch
LT	Level Transmitter
ZS	Limit Switch
M	Manual Station
M/A	Manual / Automatic Station
MOV	Motor Operated Valve
PB	Pushbutton
PC	Pressure Controller
PDI	Pressure Differential Indicator
PDS	Pressure Differential Switch
PDT	Pressure Differential Transmitter
PI	Pressure Indicator
PP	Pressure Test Point
PS	Pressure Switch
PT	Pressure Transmitter
PWS	Power Supply
PDC	Pressure Differential Controller
R	Recorder (control panel)
SE	Speed Element
SPS	Speed Switch
SR	Square Root Extractor
SS	Selector Switch
SSE	Special Supervisory Elements
SST	Special Supervisory Transmitter
ST	Speed Transmitter
SV	Solenoid Valve
TAB	Temperature Averaging Box
TC	Temperature Controller
TE	Temperature Element
TI	Temperature Indicator
TP	Temperature Test Point
TS	Temperature Switch
TT	Temperature Transmitter
TW	Temperature Test Well
TYP	Typewriter / Printer
VE	Vibration Element
VR	Vibration Relay (Proximitator / Transducer)
VS	Vibration Switch
VT	Vibration Transmitter
WI	Weight Indicator
ZI	Position Indicator
ZSC	Position Switch Closed
ZSO	Position Switch Open
ZT	Position Transmitter

Jc
AMP

d. Sequence Number

Three digit number sequences are the normal practice for power projects. Serial numbering shall be preferred in lieu of process variable parallel numbering. This ensures that all items within a loop have the same sequence number regardless of the leading process variable character in the Function Code. Lower order numbers shall be padded with leading zero's to maintain a standard length. Refer to Section 3.2.g for numbering examples.

Numbering shall start at the primary measurement point and chain through the loop until it encounters the last element; e.g. valve, receiver, etc. or intersects another loop. When multiple sensors; e.g. three voting transmitters, are used to measure the same variable alpha suffixes shall be assigned to differentiate those sensors. Otherwise, independent sensors, e.g. separate transmitters for control and shutdown, shall be tagged with unique loop numbers.

e. Suffix

A suffix is used when a loop has more than one instrument with the same function code. Alphabetic, numeric or alphanumeric characters may be used but shall be implemented in a consistent manner. Preference should be given to the use of single alpha suffixes since it is the most common method. If allowed by the instrument data management system an alpha suffix used without a dash may be used to represent associated parallel or redundant trains. Non-dashed suffixes are preferred for use with parallel items within the same system or piece of equipment; e.g. furnace pass control flow loops.

To avoid problems with existing documentation a suffix shall not be added to existing instrument items once they are entered into the instrument index. In these cases, suffix use shall begin with the second; i.e. added, item using that function code.

Instrument identification on a project is the responsibility of the Control Systems discipline and should relate to the appropriate system. It is desirable that the instrument tag numbers start at the beginning of the process system and finish at the end. Pre-assigning numbers in blocks to various systems assists with maintaining this sequence. It is preferable that instrument tags not be assigned until the process is fully defined on the P&ID's. Process changes after initial instrument tagging creates disorganized numbering due to deletions and out-of- sequence additions.

Redundant or parallel loops may use the same sequence number but differ by using a non-dashed suffix. Refer to Section 3.2.g for examples of numbering for redundant measurements and parallel equipment. The alternative parallel numbering method using the lower order digits of the sequence number to differentiate equipment trains; e.g. dual reactors should be implemented using the three lower digits. The allocation of a hundred sequence numbers; i.e. using just the two lower order digits, per train is often inadequate.

Before proceeding with the instrument numbering, the limitations of pre-selected or existing control systems shall be considered. Some systems limit tags to as few as eight characters. Also, some suppliers have format limitations, i.e., tags must start with an alpha character.

To the extent possible, I/O tag assignments shall be based upon the tag number of the instrument to which they are connected. Internal system points not connected to an instrument may require the use of special sequence numbers.

Devices that are bulk purchased items; such as instrument calibration valves and manifolds, do not require unique ISA based numbers. Stock codes, specification or mark numbers identify these generic bulk items.

Except for corrections, tag numbers, once assigned, shall not be reused. When an instrument or entire loop is deleted tag numbers are not used again. This prevents confusion with any legacy documents and correspondence on which the deleted item appears. Also, for the same reason instruments shall not be retagged. See also Section 3.2.f (above) for the prohibition concerning the addition of subsequent suffixes to established tag numbers.

f. Examples of Serial Loop Numbering

- *Redundant measurements: Differ only in suffix, e.g., three furnace pressure transmitters, 2-CB-PT-001A, 2-CB-PT-001B, 2-CB-PT-001C.*
- *Parallel equipment: Follow the mechanical equipment suffix designation, e.g., discharge pressure for two de-mineralizer feed pumps tagged 2-MU-MP-001A and 2-MU-MP-001B would have instrument tags 2-MU-PI-003A and 2-MU-PI-003B; for pumps tagged without suffixes, e.g., 2-MU-MP-004 and 2-MU-MP-005, use separate loop numbers without a suffix, e.g. 2-MU-PI-010 and 2-MU-PI-011.*
- *Multiple measurements for a single component: DO NOT use a common loop number with a suffix to differentiate between different measurements on the same component, e.g., instruments sensing suction and discharge pressure on a pump should have different loop numbers.*

3.3 Instrumentation Equipment Identification

Instrumentation equipment items are devices that require unique identification numbers. These are items that are shipped separately; e.g. system shipping sections, or to which reference is required during design, construction or startup. Typically, these are miscellaneous items that are not listed in the project equipment list; i.e. they are not treated as a standard instrument.

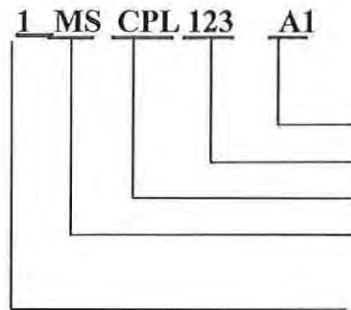
Listed below are some of items this would include:

- Control System Packages
- Embedded Multifunction Processors or PLCs

- Process Sample Systems
- Line Drivers, Modems, Data Transfer Devices
- Printers
- System Cabinets
- Field Control Panels

To ensure proper management the use of these numbers should be maintained on a common list. This list may be an independent document or part of the instrument index.

The “visible label” of a control system component includes three standard elements (Function Code, Sequence Number, and Suffix), which may be supplemented by three additional elements (Unit Number, Separation Group and System Locator Code) located ahead of the Function Code.



- e. Suffix (When Needed)
- d. Sequence Number
- c. Function Code
- b. System Identifier
- a. Unit Number

a. Unit Number

The Unit Number is assigned according to Section 3.2.a and used in an identical manner.

b. System Identifier Code

See Systems Identifiers in Section 1 of this Appendix.

c. Function Code

The Function Code for equipment identification uses up to three characters. To differentiate Equipment from standard instruments the Function Codes should not be based on standard ISA identifiers. The following codes are typical but other codes for items; e.g. junction boxes, may be used based upon local practices:

Two handwritten signatures in blue ink are located in the bottom right corner of the page.

ANB	Analyzer Building or Shelter
ANN	Annunciator Chassis, Alarm Horn or Beacon
CAB	PLC Cabinet & I/O
CPL	Control Panel, Sample System, Shipping Section, etc.
CPU	Logic Sequencer, Embedded Multifunction Processor
CRD	Card or Slot in a Rack/Chassis
IA	Multi-port Air Manifold
IJB	Instrument Junction Box
ILR	Instrument Local Rack / Stand
JCB	BMS Cabinet & I/O
JCD	DCS Cabinet & I/O
JCT	TCS Cabinet & I/O
MX	Multiplexer, Line Drivers, Modem, Misc. Network Device
PRT	Printer, Screen Copier, Multi-point Recorder
PS	DC Power Supply
RCK	Chassis or Card Rack in a Cabinet or Panel
RIE	Remote Instrument Enclosure or Satellite Building
STN	Operator Station, PC Work Station

When applicable the tagging of large pre-packed analyzer shelters and control buildings shall conform to the overall project procedures for identifying structures or Equipment items.

d. Sequence Number

The Sequence Number by default uses a two-digit number. Lower order numbers shall be padded with leading zero's to maintain a standard length. For DCS, BMS, TCS and PLC cabinets, the main cabinet with processor and the associated I/O cabinets will share a sequence number; an alphabetic suffix will be used to designate the remote I/O cabinets.

e. Suffix

The Suffix is assigned according to Section 3.2.f and used in an identical manner. Optionally, a non-dashed suffix V; for example 05-IJB-032V, may be added to the sequence number to designate vendor supplied junction boxes.

3.4 Codes and Standards

ISA S5.1 - Instrumentation Symbols and Identification, Current Revision.

IEEE 315 (ANSI Y32.2) - Graphic Symbols for Electrical and Electronics Diagrams, Current Revision.

3.5 Separation Group Codes

- A, B, C & D Safety Related Electrical Separation Groups. (Not Used)
- F & G Not Safety Related Electrical Separation Groups. (Note 2)
- S Safety Related, not included in a separation category.

NOTES:

1. Deleted.
2. Two balance of plant groups have been established if required by project to meet the requirements of identifying balance of plant separation groups.

4. Electrical Equipment Numbering Convention

4.1 Switchgear, motor control centers, area terminal boxes and junction boxes, low voltage power distribution panels and lighting panels will be numbered using a facility designator. All other electrical equipment will be numbered using Section 4.2, unless approved by LG&E.

Examples:

Switchgear, motor control centers, terminal boxes, distribution and lighting panels

2 TM MC A 1
 \overline{A} B \overline{C} D \overline{E}

Show on drawings as 2TMMCA1.

A - Unit Numbers

- 1 - Unit 1
- 2 - Unit 2
- 0 - Common

B - Facility Identifier

Area and landing or elevation. Note the elevation or landing is not always used, especially in the outlying buildings where there is only one floor where electrical equipment can be located.

Code	Area and Landing
AP	Ash Pond Electrical Building
BG	Boiler Building, Ground Floor
BM	Boiler Building, Mezz Floor
BO	Boiler Building, Operating Floor
BP	Boiler Building, any platform elevation above the main floor

CD	Coal Dock
CR	Crusher House Electrical Building
CT	Cooling Tower Building
FA	Flyash Electrical Building
FF	Pulse Jet Fabric Filter Electrical Building/Room
MB	Aux Boiler
PR	Dry Precipitator Electrical Building/Room
RP	Reactant Preparation Electrical Building
RT	CCRT Electrical and Control Building
SD	Wet FGD Electrical Building/Room
SF	Service Building, elev. 546’-6”
SH	Screen House Building
SN	Service Building, Upper Mezz
SO	Service Building, Operating Floor
SU	Service Building, Upper Ground Floor
TG	Turbine Building, Ground Floor
TM	Turbine Building, Mezz Floor
TO	Turbine Building, Operating Floor
WP	Wet Precipitator Electrical Building/Room
WT	Water Treatment Building

C - Commodity Codes

The following codes are typical but additional codes may be used if required:

MC	Motor Control Centers and Distribution Panels
PB	Pull box (no terminations)
TB	Terminal Box
R	Receptacle Panel
L	Lighting Panel

D - Electrical Source

The electrical bus source for the motor control center or panel, either an “A” system or a “B” system.

- Assign letters from North (A) to South (B) or from East (A) to West (B), or from top (A) to bottom (B). In combination, prioritize numbering from top to bottom first, then from north to south, and from east to west last.
- The naming of electrical bus source for the 7kv, 4kv or 480v switchgear or close coupled transformer and switchgear must be named looking at the FRONT of the switchgear: A line-up is always on the LEFT; B line-up is always on the Right.

E - Sequence Number

A sequential number assigned to uniquely identify equipment.

4.2 System based electrical equipment.

Examples:

Other electrical equipment.

2 -	TBO -	EP -	001	A
-	--	---	---	-
A	B	C	D	E

Show on drawings as 2-TBO-EP--001A.

A - Unit Numbers

- 1 - Unit 1
- 2 - Unit 2
- 0 – Common

B - System Identifiers

See Systems Identifiers in Section 1 of this Appendix.

C - Commodity Codes

The following codes are typical but other codes may be used based upon local practices:

Code	Description
EA	Instrument and Preferred AC Power
EB	Bus Ducts and Supports
ED	Direct Current Equipment
EE	Electronic, Multiplexer and Optical Equipment
EF	Communication/Telecommunication Equipment
EG	Grounding and Lightning Protection
EK	Power Centers and Low Voltage Distribution Centers
EM	Motors
EP	Local Control Stations/Panels
EQ	Cathodic Protection
ET	Transformers
EU	Uninterruptible and Vital AC Power
EV	Adjustable Speed Drives
EY	Electrical Specialty Equipment
EZ	Switchyard/Substation, Distribution and Transmission

D - Sequence Numbers

001 through 999

Leading zeros are to be shown on drawings, Set route, etc.

E - Suffix

A-Z, except I and O

Use when there is redundant counterpart.

Use A, C, E, G, J, L, N for "A" side power fed equipment.

Use B, D, F, H, K, M, P for "B" side power fed equipment.

Do not use suffix if equipment has no redundant counterpart.





TRIMBLE COUNTY GENERATING STATION

COAL COMBUSTION RESIDUALS TREATMENT (CCRT) DCS Specification

Engineering Design Standards Version 1.0

Release Date September 16, 2014 (Updated by LG&E) Rev 1 March 25, 2015



112 Ingle St.
Evansville, IN 47708

(812) 425 4264



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- Exhibit X, APPENDIX D – SPECIFICATIONS FOR ELECTRONIC SUBMITTAL OF ENGINEERED DRAWINGS
- EXHIBIT X, APPENDIX F - TRIMBLE COUNTY COMPONENT NUMBERING

1.0 Purpose

The engineering design standards document provides the project team a guideline for implementing a DCS system upgrade. This document will also provide DCS Contractor, LG&E and PCI an opportunity to maintain consistent deliverables.

2.0 Scope

This document will identify to engineers, designers, database engineers, and CAD technicians how certain tasks throughout the project will be implemented. It is the responsibility of the project team to continue to provide updates and corrections to these design standards.

3.1 Engineering Design Standards

Assigning New Drawings

Prior to beginning the development of any new drawing the engineer will assign a drawing number and log that number in the Master Drawing Index.

3.2 Drawing Number Standards

All Owner Unit X existing plant documentation shall maintain their existing drawing number. New drawings created by PCI will follow standards identified in Table 1.0. Either DCS Vendor or Owner will assign any drawing type not classified within that structure.

3.2.1 Table 1.0 “Drawing Number Standards”

E-XXXX.YY E = The Type of Drawing		Example: TC1-E-3175.YY	
Location/Unit#	Code	Set by LG&E	Developed from Table
Unit 0 = TC0-	E-	3000.YY	(E-3XXX.YY) example E-3000.YY (Common/Misc.)
Unit 1 = TC1-	E-	3250.YY	(E-34XX.YY) example E-3250.YY (TC1 Boiler Group)
Unit 2 = TC2-	E-	3250.YY	(E-325X.YY) example E-3250.YY (TC2 Boiler Group)

3.2.2 Table 1.1 “Code Assignment”

Code Assignment for Drawings		
A = Architectural	FP = Fire Protection	S = Structural
C = Concrete	G = Civil, Underground Piping	V = HVAC
DE = Demolition	I = Insulation	Z = Instrumentation / Logics
E = Electrical	M = Mechanical	

3.2.3 Table 1.2 “Sub-System Codes”

Sub-System Codes	XXXXX=Unit #	YY=00-99 (Sheet Number assigned by LG&E/PCI)
3000.YY = Common / Misc. (COM)	3400.YY = Motor Controls / Balance of Plant (BOP)	3650.YY = Precipitator Control System (PCS) see note 1
3100.YY = Coal Handling System (CHS)	3450.YY = Data Acquisition (DAS)	3650.YY = Pulse Jet Fabric Filter (QFF) see note 1
3150.YY = Limestone Handling Control (LHS)	3500.YY = Soot Blower Controls (SBS)	3700.YY = Sulphur Dioxide Removal System (FGD)





Sub-System Codes XXXXX=Unit # YY=00-99 (Sheet Number assigned by LG&E/PCI)		
3200.YY = Water Treatment Controls (WTS)	3550.YY = Ash Handling Controls (AHS)	3750.YY Gas Combustion Turbine (CTG)
3250.YY = Boiler Controls (BCS)	3551.YY = Ash Handling Controls (AHS)	3800.YY = Dry Sorbent Injection (DSI)
3300.YY = Burner Management (BMS)	3600.YY = Selective Catalytic Reduction (SCR)	3850.YY = Coal Combustion Residuals (CCR)
3350.YY = Turbine Controls (TCS)		

Note 1: These are the same because on TC2 Bechtel included the PJFF and the Precipitator Control drawing in the same series of prints. On TC1 the PJFF is dedicated to print subsystem code "3650" and the Precipitator Controls fell under the Common/Miscellaneous print subsystem code.

3.2.4 Table 1.4 "New Fields in Drawing Database" – Also See Appendix A of this Document and Exhibit X, APPENDIX D

Index Field	Example
Drawing Number	E-3400, M-3000, Etc.
Type	Electrical, Mechanical, Etc.
Revision	Preliminary are 1,2,3, etc.; then issued the first time no revision, first rev and forward are A, B, C, etc. skip I and O
Revision Date	Month/day/year
Sheet Number	1, 2, 3, Etc.
Vendor	MVI, BV, Etc.
Title Row 1	Electrical, ELEM & INTERCONNN, Etc.
Title Row 2	4160 SWGR, 480 V Motor Control, Etc.
Title Row 3	BRKER "A2A", MCC A2A, Etc.
Title Row 4	ECT.
Comments	As Applicable
Purge (Check-Box)	End User Should Purge from Their Files
Issue AS-Built (Check-Box)	Drawing was Modified as Part of DCS Upgrade
Not In Scope (Check-Box)	Drawing was not Changed as part of DCS Upgrade
New (Check-Box)	New Drawing Developed by PCI

3.3 PCI Database Index and Color Convention

3.3.1 Table 1.6 "Color Abbreviation Standards"

Color	Abbreviation	Color	Abbreviation
Black	B	Blue	U
White	W	Gray	GY
Red	R	Yellow	Y
Green	G	Brown	Br
Orange	O	Purple	P



3.4 IO Database Standards

3.4.1 Table 1.5 “PCI Database Index Numbering Convention”

System	Range
CCR	50000-52999

3.4.2 Table 2.0 “Engineering Unit Descriptors”

The Engineering Unit Descriptor is used to define the process measurement units for analog points. This field is limited to 6 characters.

Engineering Units	Abbreviation
AMPERES	A
BTU PER POUND	BTU/LB
CYCLES	CYCLES
DEGREES	DEGREE
DEGREES C (Electrical winding temperature)	DEGC
DEGREES F (Process temperature)	DEGF
DEGREES F PER MINUTE	DEGF/M
DISPLACEMENT	MILS
FEET	FT
FREQUENCY	HZ
GALLONS	GAL
GALLONS PER MINUTE	GPM
HOUR	HR
INCHES	IN
INCHES MERCURY	INHG
INCHES PER HOUR	IN/HR
INCHES PER SECOND	IN/SEC
INCHES WATER COLUMN	INWC
KILOAMPS	KA
KILOVOLTS	KV
KILOWATTS	KW
MEGAVARS	MVARS
MEGAWATT HOURS	MWH
MEGAWATTS	MW
MEGAWATTS PER MINUTE	MW/MIN
MICROGRAMS PER LITER	uG/L
MICROOHMS	Uohm
MILES PER HOUR	MPH
MILLIAMPS	mA
MILLIGRAMS PER LITER	mG/L
MILLION BTU PER HOUR	MBTU/H
MILLIVOLTS	mV
MINUTES	MIN
PARTS PER BILLION	ppb
PARTS PER MILLION	ppm

Engineering Units	Abbreviation
PER MINUTE	
PERCENT	PCT
PH	PH
POUNDS	LBS
POUNDS PER HOUR	PPH
POUNDS PER POUND	PPP
POUNDS PER SQ. IN. ABSOLUTE	PSIA
POUNDS PER SQ. IN. DIFFERENTIAL	PSID
POUNDS PER SQ. IN. GAUGE	PSIG
PSIG PER MINUTE	PSIG/M
REVOLUTIONS PER MINUTE	RPM
RPM PER MINUTE	RPM/M
RPM PER SECOND	RPM/S
SECONDS	SEC
STANDARD CU. FT. PER MINUTE	SCFM
THOUSAND CU. FT. PER MINUTE	KCFH
THOUSAND GALLONS PER HOUR	KGPH
THOUSAND POUNDS	KLBS
THOUSAND POUNDS PER HOUR	KPPH
THOUSAND STANDARD CU. FT.	KSCFM
TONS	TONS
TONS PER HOUR	TPH
VOLTS	V

3.4.3 Table 3.0 “Abbreviation Standards”

When required by space constraints, the following abbreviations will be utilized for database entries. Abbreviations are limited to six characters.

Engineering Units	Abbreviation
7.2 KV	7KV
13.8 KV	14KV
138 KVA	138KV
18 KV	18KV
22 KV	22KV
25 KV	25KV
345 KV	345KV
4.16 KV	4KV
480V	480V
ABNORMAL	ABNRM
ABSOLUTE	ABS
ACID INJECTION PUMP	AIP
ACKNOWLEDGE	ACK
ACTIVE	ACT
ACTIVE PILE	ACTPLE
ACTUATED	ACTUAT
AGITATOR	AGIT
AIR IN / GAS OUT	A/G
AIR REMOVAL	AR
AIR SUPPORT FAN	ASF
ALARM	ALM
ALTERNATING CURRENT	AC
AMPERAGE	AMP
ANALYZER	ANLZR
ANNUNCIATOR	ANN
APPROACH	APP
AS DELIVERED SAMPLER	AS-DEL SMPLR
ASH BOOSTER PUMP	ABP
ASH SLUICE PUMP	ASP
ATTEMPERATOR	ATTMP
AUTOMATIC	AUTO
AUX OIL PUMP	AOP
AUXILLARY	AUX
AVAILABLE	AVAL
AVERAGE	AVG
BACKUP	BKUP (BKU)
BACKWASH	BKWSH
BATTERY	BATT
BEACON	BCN
BEARING	BRG
BLEED	BLD
BLOWDOWN	BLWDN
BLOWER	BLWR
BLOWING	BLWG
BLOWN	BLOWN
BOILER	BLR
BOILER CIRCULATING PUMP	BCP

Engineering Units	Abbreviation
BOILER FEED PUMP	BFP
BOILER FEED PUMP TURBINE	BFPT
BOOSTER	BSTR
BOTTOM	BTM
BOTTOM ASH CRUSHER	BAC
BOTTOM ASH HOPPER	BAH
BREAKER	BKR
BREECHING	BRCH
BROMINATOR	BRMNTR
BUILDING	BLDG
BURNER	BRNR
BURNER AIR REGISTER	BAR
BURNER SHUTOFF	BSO
BYPASS	BYP
CALCULATION	CALC
CALIBRATION	CALB
CARBON DIOXIDE	CO2
CASING	CSG
CATHOTIC	CATH
CENTER	CNTR
CHAMBER	CHMB
CHARGER	CHRGR
CHARGING	CHRG
CHECK	CHK
CHEMICAL	CHEM
CHEST	CHST
CHIMNEY	CHIM
CIRCULATING	CIRC
CIRCULATING WATER PUMP	CWP
CLARIFIER	CLRFR
CLEAR WELL WATER	CWW
CLEARWELL	CLRWEL
CLOSE	CLS
CLOSED	CLSD
CLOSED COOLING HEAT EXCHANGER	CCHE
CLOSED COOLING PUMP	CCP
CLOSED COOLING WATER	CCW
COAGULANT	COAG
COLD AIR DAMPER	CAD
COLD END TEMP	CET
COLLECT	COLL
COMBINED	COMB
COMMAND	CMD
COMMON	COMN
COMPARTMENT	CMPT



Engineering Units	Abbreviation
COMPLETE	CMPLT
COMPRESSOR	COMPR
COMPUTER	CMPTR
CONDENSATE	COND
CONDENSER	CDSR
CONSTRUCTION AIR	CA
COOLER	CLR
COOLING	CLG
COOLING TOWER	CT
COOLING TOWER PUMP	CTP
CORNER	COR or CRN
COUNTER	CTR
COUPLED	CPLD
COUPLING	CPLG
CRUSHER	CRSHR
CURRENT	CURR
CYLINDER	CYL
DAMPER	DMPR or DMP
DE ENERGIZE	DENRGZ
DEAERATOR	DEA
DECREASE	DEC
DEFEAT	DEFEAT
DELIVERED	DLVRD
DELIVERY	DLVRY
DELUGE	DEL
DEMINERALIZER	DEMIN
DEMISTER	DMSTR
DENSITY	DEN or D
DENSITY TRANSMITTER	DT
DESUPERHEATER	DESH
DETECTED	DET
DEVIATE	DEVIAT
DIAPHRAGM	DIAPH
DIESEL	DIESL
DIFFERENTIAL	DIFF
DIFFERENTIAL PRESSURE	D/P
DIFFERENTIAL TEMPERATURE	D/T
DIFFUSER	DFFSR
DILUTION	DILUTN
DIRECT CURRENT	DC
DIRECTION	DIR
DISABLED	DISABL
DISC LINE	DL
DISCHARGE	DISCH
DISCHARGE VALVE	DISCVLV
DISENGAGE	DSENG
DISPERSANT	DSPSNT
DISTRIBUTED CONTROL SYSTEM	DCS
DISTRIBUTION	DIST
DIVISION	DIV

Engineering Units	Abbreviation
DIVISION PANEL	DIVP
DOWN	DOWN
DOWNCOMER	DNCR
DOWNSTREAM	DNSTRM
DRAFT	DRFT
DRAIN	DRN
DRAIN COOLER	DCLR
DRAIN COOLING APPARATUS	DCAPR
DRAIN COOLING APPROACH	DCA
DRAWING	DWG
DRIVE	DRV
EAST	E
ECCENTRICITY	ECC
ECONOMIZER	ECON
EFFICIENCY	EFF
EFFLUENT	EFFL
ELECTRIC (AL)	ELEC
ELECTRO/HYDRAULIC CONTROL	EHC
ELEVATION	ELEV or ELV
ELIMINATOR	ELIM
EMERGENCY	EMER
EMERGENCY RELIEF VALVE	ERV
ENABLED	ENABLD
ENCLOSURE	ENCLSR
ENERGIZE	ENRGZ
ENGAGE	ENGAG
ENGAGED	ENGAGD
ENGINE	ENG
EQUIPMENT	EQUIP
EXCESS	EXCESS
EXCITER	EXC
EXHAUST	EXHT or EXH
EXHAUSTER	EXTR
EXPANSION	EXP
EXTEND	EXTND
EXTENDED	EXTNDD
EXTERNAL	EXT
EXTRACTION	EXTRCT
FAILURE	FAIL
FAULT	FLT
FAULTED	FLTD
FEEDER	FDR
FEEDWATER	FW
FEET	FT
FILTER	FLTR
FIRE	FIRE
FIRE OUT	FROUT
FIRE PROTECTION	FR_PROT
FIRE PUMP	FR PMP
FLAME	FLM



Engineering Units	Abbreviation
FLANGE	FLG
FLOODLIGHT	FLDLGT
FLOW	FLW
FLOW TRANSMITTER	FT
FLUE GAS	FLUEGAS
FLUID	FLD
FLUID DRIVE	FLDR
FLUSH	FLSH
FLUSHING	FLSHG
FORCE DRAFT	FD
FORCE DRAFT FAN	FDF
FORWARD	FWD
FREQUENCY	HZ
FRONT	F
FULL LOAD	FULLD
FULLY CLOSED	FLCLSD
FURNACE	FURN
GALLONS PER HOUR	GPH
GALLONS PER MINUTE	GPM
GAS	G
GAS RECIRCULATION FAN	GRF
GATHERING	GTHRNG
GEARBOX	GRBX
GENERATOR	GEN
GLAND	GLD
GOVERNOR	GOV
GREATER THAN	>
GROUND	GRD
GROUNDING	GRDED
GUIDE	GIDE
HAND AUTO STATION	M/A
HANDLING	HDLG
HEADER	HDR
HEAT RATE	HR
HEAT TRACE	HTRACE
HEATER	HTR
HI OR LO	HILO
HIGH	HIGH
HIGH INTERMEDIATE PRESSURE	HIP
HIGH LEVEL ALARM	HLA
HIGH PRESSURE	HP
HIGH PRESSURE HEATER RAIN PUMP	HPHDP
HIGHLIGHTED	HGHLTD
HONEYWELL	HYWL
HOPPER	HOPR
HORIZONTAL	HORZ (HOR)
HORZ SERVICE WATER PUMP	HSWP
HOT AIR DAMPER	HAD
HOTWELL PUMP	HWP

Engineering Units	Abbreviation
HUMIDIFICATION	HUMD
HUMIDITY	HUM
HYDRAULIC	HYD
HYDRAULIC POWER UNIT	HPU
HYDROGEN	H2
HYPOCHLORITE	HYPCHL
IGNITER	IGN
IGNITER FLAME TRIP	IFT
IGNITION	ING
IMPELLER	IMPL
IN	IN
INACTIVE	INACT
INBOARD	INBD
INBOARD BEARING	IBRG
INCHES MERCURY	INHG
INCHES OF WATER COLUMN	INWC
INCREASE	INC
INDICATED	IND
INDICATION	IND
INDUCED DRAFT	ID
INDUCED DRAFT FAN	IDF
INDUCED DRAFT FAN	IDF
INITIATE	INIT
INLET	INLT
INSERT	INSRT
INSERTED	INSRTD
INSTRUMENT	INST
INTEGRATOR	INTG
INTENSITY	INT
INTERLOCK	INTLK
INTERUPTED	INTRPT
INVERTER	INVRTR
ISOLATED	ISOLD
ISOLATION	ISOL
ISOLATOR	ISOLTR
JUNCTION	JCT
LADDER	LADR
LEAK OFF	LKOF
LEFT	L
LESS THAN	<
LEVEL	LVL
LEVEL TRANSMITTER	LT
LIGHT	LGT
LIGHTOFF	LGTOFF
LIMESTONE	LSTONE (LSTN)
LIMESTONE SLURRY	LSLURRY
LIMIT	LIM
LIMITING	LIM
LIQUID	LIQ
LIQUOR	LIQR
LOCAL	LOC
LOCK-OUT	LKOT

Engineering Units	Abbreviation
LONG	LONG
LONG SHAFT SERVICE WATER PUMP	LSSWP
LOW	LOW
LOW – LOW	LO-LO
LOW INTERMEDIATE PRESSURE	LIP
LOW LEVEL ALARM	LLA
LOW PRESSURE	LP
LOW PRESSURE HEATER DRAIN PUMP	LPHDP
LOW PRESSURE SERVICE WATER PUMP	LPSWP
LOW START	LOSTRT
LOW START	LOSTRT
LOWER	LWR
LOWER BEARING	LBRG
LUBE OIL	LUBOIL
LUBRICATING	LUB
MAIN CONTROL BOARD	MCB
MAKE-UP	MKUP
MALFUNCTION	MALF
MANIFOLD	MNFLD
MANUAL	MAN
MANUAL START	MNSTRT
MASTER FUEL TRIP	MFT
MAXIMUM	MAX
MEASURE MODE	MEAS_MD
MEGAVARRS	MVAR
MEGAWATTS	MW
METAL	MTL
MIDPOINT	MID
MINIMUM	MIN
MIST ELIMINATOR	ME
MODULE	MOD
MOTOR	MTR
MOTOR DRIVEN BOILER FEED PUMP	MDBFP
MOTOR OPERATED VALVE	MOV
NO	NO
NO COAL	NOCOAL
NO FLOW	NOFLW
NORMAL	NORM
NORTH	N
NOT ACTIVE	N_ACT
NOT AUTOMATIC	N_AUTO
NOT AVAILABLE	N_AVAL
NOT BLOWING	N_BLWG
NOT CALIBRATED	N_CALB
NOT CLOSED	N_CLSD
NOT ENGAGE	N_ENGD
NOT E-STOP	N_ESTP

Engineering Units	Abbreviation
NOT FAULT	N_FLT
NOT HIGH	N_HI
NOT INSERTED	N_NSRT
NOT LIMITING	N_LIM
NOT LOW	N_LO
NOT MAINTANENCE	N_MAINT
NOT MALFUNCTIONED	N_MALF
NOT MEASURE	N_MEAS
NOT OK	N_OK
NOT OPEN	N_OPN
NOT OPEN STANDBY	N_OPST
NOT RESET	N_RST
NOT RUN	N_RUN
NOT RUNNING	N_RNG
NOT TRAVEL	N_TRVL
NOZZLE	NZLE
NUMBER	NO
OFF	OFF
OK	OK
ON	ON
ONLINE	ONLINE
OPACITY	OPAC
OPEN	OPN
OPENED	OPND
OPERATED	OPRTD
OPERATING	OPRTNG
OPTICAL	OPT
ORIFACE PLATE	ORF_PLT
OUT	OUT
OUTBOARD	OTBD
OUTBOARD BEARING	OBRG or OTBRG
OUTER CYLINDER	OUTCYL
OUTLET	OTLT
OVER CURRENT RELAY	OCRLY
OVER FLOW	OVRFL
OVERLOAD	OVLDT
OVERSPEED	OVSPD
OVERTRAVEL	OVTRVL
OVERVOLTAGE	OVRVLT
OXIDATION AIR	OX AIR
OXYGEN	O2
PANEL	PNL
PARALLEL	PARALL
PARTS PER BILLION	PPB
PARTS PER MILLION	PPM
PATTERN	PATT
PENDANT	PN
PERCENT	PCT or %
PERMISSIVE	PERM
PERMIT	PRMT
PH	PH



Engineering Units	Abbreviation
PLATEN	PL
PLUGGED	PLGD
POLYMER	POLY
POSITION	POSN
POWER	PWR
POWER	PWR
PRECIPITATOR	PRECIP or ESP
PRECISION	PRCSN
PREFIRE	PRFIRE
PREHEATER	PRHTR
PREQUENCH	PRQNCH
PRESSURE	PRESS or PRS or P
PRESSURE RELIEF VALVE	PRV
PRESSURE TRANSMITTER	PT
PRIMARY	PRI
PRIMARY AIR DAMPER	PAD
PRIMARY AIR FAN	PAF
PRIMARY SUPERHEATER	PSH
PROBE	PROB
PRODUCT	PROD
PROGRAMMABLE	PRGRMBL
PROTECTION	PROT
PROVEN	PRVN
PULSION	PULSN
PULVERIZER	PULV
PUMP	PMP
PURGE	PURG
PURITY	PRTY
PUSH BUTTON	PB
QUENCH	QNCH
RADIAL	RDL
RADIANT	RAD
RAPPER	RAPR
REACTANT	RCTNT
REACTANT SUPPLY PUMP	RSP
REACTION	RCTN
REAR	R
RECIRCULATING	REC
RECIRCULATION	RECIRC
RECIRCULATION PUMP	RECPMP
RECLAIM	RECLM
RECLAIMER	RECLMR
RECTIFIER	RECT
RECYCLE	RCYL or RCYC
REDUCER	RDCR
REFERENCE	REF
REGENERATION	REGEN
REHEAT	RH
REHEATER	RHR
RELAY	RLY
RELEASE	RELS

Engineering Units	Abbreviation
REMOTE	RM or REM
REMOTE AUTO	RMAUTO
REQUIRED	REQ
RESERVE	RES
RESERVOIR	RESVR
RESET	RESET
RESISTANCE TEMPERATURE DETECTOR	RTD
RETAINER	RETNR
RETRACT	RTRCT
RETRACTED	RTRCTD
RETURN	RTN
REVERSE	REV
RIGHT	R
ROOM	ROOM (RM)
ROTATION	ROT
ROTOR	RTR
RUNNER	RUNR
RUNNING	RUNG or RUNING
SAMPLE	SAMP
SAMPLER	SMPLR
SATURATED	SAT
SCANNER	SCNR
SCANNER AIR BOOSTER FAN	SABF
SCANNER AIR FAN	SCNAF
SCAVENGE	SCVG
SCREENER	SCRNR
SCREENHOUSE	SCRNHSE
SCRUBBER	SDRS
SCRUBBING OR SCRUBBER	SCRUB
SEAL	SL
SEAL AIR FAN	SLAF
SECONDARY	SEC
SECTION	SECT
SELECT	SEL
SELECTED	SELCTD
SELECTOR	SELCTR
SEPARATOR	SEPRTR
SEQUENCE	SEQ
SERVICE	SERV
SERVICE AIR COMPRESSOR	SAC
SET POINT	SETPT (SP)
SHAFT	SHFT
SHELL	SHL
SHORT	SHORT
SILENCE	SIL
SILENCER	SILNCR
SLUICE	SLCE
SLURRY	SLRY
SOLENOID	SOL



Engineering Units	Abbreviation
SONIC HORN	SNC_HN
SOOTBLOWER	SOOTBLW or STBWLR or STBLW
SOOTBLOWER AIR COMPRESSOR	SBAC
SOUTH	S
SPEED	SPD
SPEED PERMIT	SPDPMT
SPRAY	SPRY
STACK	STK
STAGE	STG
STANDBY	STDBY
START	STRT
STARTED	STRTD
STARTER	STRTR
STATION	STA
STATOR	STR
STATOR COOLING WATER PUMP	SCWP
STEAM	STM
STEAM COIL AIR HEATER	SCAH
STEP	STEP
STOP	STOP or STP
STOPPED	STPD
STORAGE	STRG
SUBSTATION	SUBSTR
SUCTION	SUCT
SUDDEN	SUD
SULFUR DIOXIDE	SO2
SULFUR DIOXIDE REMOVAL SYSTEM	SDRS
SUPERHEAT	SH
SUPERHEATER	SHTR
SUPPLY	SPLY
SUPPORT	SUPP
SWITCH	SW
SWITCHGEAR	SWGR
SYSTEM	SYS
TACHOMETER	TACH
TANK	TNK
TELESCOPIC	TELESC
TEMPERATURE	TEMP or TMP or T
TEMPERATURE AVERAGING BOX	TAB
TERMINAL	TERM
THERMAL	THRML
THERMOCOUPLE	T/C
THICKENER	THKR
THICKENER UNDERFLOW PUMP	TUF

Engineering Units	Abbreviation
THOUSAND POUNDS PER HOUR	KPPH
THROUGH	THRU
THRUST	THST
TOTAL	TOTL
TOWER	TWR
TRAINING	TRNG
TRANSCEIVER	XCVR
TRANSDUCER	XDCR
TRANSFER	XFER
TRANSFORMER	XFMR
TRANSMISSION	XMSN
TRANSMITTER	XMTR
TRANSMITTING	XMTG
TRAVEL	TRVL
TREATMENT	TRTMNT
TRIP RESET	TRPRST
TRIPPED	TRIP
TRIPPER	TRIPR
TROLLEY	TRLLY
TROUBLE	TRBL
TURBIDITY	TURBTY
TURBINE	TURB
TURBINE DRIVEN BOILER FEED PUMP	TDBFP
TURBINE OIL	T/O
TURNING GEAR	TG
ULTRA VIOLET LIGHT	UVL
UNDER VOLTAGE	U/V
UNGROUNDING	UNGRD
UNINTERRUPTABLE POWER SUPPLY	UPS
UPPER	UPR
UPPER BEARING	UBRG
UPSTREAM	UPSTRM
VACUUM	VAC
VALVE	VLV
VAPOR	VAPR
VARIABLE FREQUENCY DRIVE	VFD
VELOCITY	VEL
VERTICAL	VERT
VIBRATION	VIB
VIBRATOR	VBRTR
VOLTAGE	V
WALLBLOWER(S)	WBLWR(S)
WARM UP GAS	WUG
WARNING	WARN
WARNING	WARN
WATER	WTR
WATER COIL AIR HEATER	WCAH

Engineering Units	Abbreviation
WATER COIL AIR HEATER PUMP	WCAHP
WATTHOUR	WHR
WATTHOUR METER	WHM
WATTMETER	WM
WEAR	WR
WEATHERPROOF	WP

Engineering Units	Abbreviation
WEIGHT	WT
WEST	W
WINDBOX	WDBX
WINDING	WDG
WRONG	WRONG
YES	YES

3.4.4 Table 4.0 “LG&E Trimble System Identifier Code”

Code	Description
ABB	AUXILIARY BOILER BLOWDOWN
ABB	AUXILIARY BOILER BLOWDOWN
AC	AUXILIARY COOLING
ACA	ACTIVATED CARBON
ACF	AUXILIARY BOILER CHEMICAL FEED
AFR	AUXILIARY BOILER FUEL OIL RETURN
AFS	AUXILIARY BOILER SUPPLY
AFW	AUXILIARY BOILER FEEDWATER
AH	ASH HANDLING
AHB	BOTTOM ASH
AM	AMMONIA
AMU	AUXILIARY BOILER MAKE-UP WATER
AN	ANNUNCIATOR
AO	ORGANIC ACID INJECTION
AP	AUXILIARY POWER
AQ	ABSORBER SLURRY CIRCULATION AND WASTE BLEED
AS	AUXILIARY STEAM
ASC	AUXILIARY BOILER STEAM CONDENSATE
AT	ATTEMPERATOR SPRAY
AU	AUTO CONTROL
AW	STATION ASH WATER
BA	BOILER COMBUSTION AIR AND FLUE GAS
BD	BOILER DRAINS AND VENTS
BFR	BOILER FEED RECIRCULATION
BFS	BOILER FEED SUCTION
BFW	BOILER FEED WARM-UP
BLB	BOILER BLOW-OFF FILL AND DRAIN
BLC	MAN AND REHEAT STEAM TEMPORARY BLOW-OUT
BLS	STEAM GENERATOR, WTR/STM SIDE
BLV	UNIT VENTILATION
BM	BURNER CONTROL AND IGNITION
BMS	BURNER MANAGEMENT
BT	BOILER METAL TEMPERATURE
CB	COMBUSTION AIR
CC	CLOSED COOLING
CCR	COAL COMBUSTION RESIDUALS

Code	Description
CD	CONDENSATE SYSTEM
CEM	CEMS, NOISE MONITORING
CF	CHEMICAL FEED
CH	COAL HANDLING
CHE	CRANES, HOISTS, ELEVATORS
CHW	SERVICE BUILDING, CHILLED WATER (SUPPLY/RETURN)
CI	CHEMICAL INJECTION
CL	ARRANGEMENT OF LINKAGE BETWEEN EQUIPMENT CONTROL DEVICES
CO	CARBON DIOXIDE
CP	CONDENSATE POLISHER
CR	COLD REHEAT
CW	CIRCULATING WATER(COOLING TOWER, CONDENSER, SUPPLY/RETURN)
CW	CIRCULATING WATER(COOLING TOWER, CONDENSER, SUPPLY/RETURN)
CX	COMPUTER (EXCLUDING INPUTS)
DB	DRAINS - BOILER ROOM FLOOR AND ROOF
DC	BATTERY AND DISTRIBUTION
DG	DIESEL GENERATOR
DR	DEAERATOR DRAIN
DSI	DRY SORBENT INJECTION
DT	DRAINS - TURBINE ROOM
E14	14 KV (13.8) SYSTEM
E40	4 KV (4.16) SYSTEM
E48	480V SYSTEM
E70	7 KV (6.9) SYSTEM
EA	EQUIPMENT DRAINS AND VENTS
ECP	CATHODIC PROTECTION
ED	DRAINS AND VENTS (DOWNSTREAM FROM PROCESS ISOLATION VALVES)
ED1	125V DC POWER
ED2	250V DC SYSTEM
EGB	MAIN GENERATOR SYSTEM
EHC	ELECTRO HYDRAULIC CONTROLS



Code	Description
ELG	GROUNDING AND LIGHTNING PROTECTION
ELP	LIGHTING POWER
EM	METERING AND PROTECTION
EPA	PUBLIC ADDRESS SYSTEM
ES	EXTRACTION STEAM
ESC	SECURITY
EUP	120V UPS SYSTEM
EWR	WELDING RECEPTACLES
FA	FLY ASH HANDLING
FC	FUEL COAL (IN PLANT) MAIN FUEL, COAL SILO VENTILATION
FO	FUEL OIL
FOI	IGNITION OIL
FP	FIRE PROTECTION
GC	GENERATOR STATOR COOLING
GS	TURBINE GLAND STEAM SEAL
GT	GAS TURBINE
HA	STATION AND HOUSE AIR
HC	HOIST AND CRANES
HD	HEATER DRAINS
HL	HYDRATED LIME (also see DSI)
HOV	HEATER OPERATING VENTS
HR	HOT REHEAT
HV	MISCELLANEOUS GAS (H2, CO2)
HW	SERVICE BUILDING, HOT WATER (SUPPLY/RETURN)
HY	HYDROGEN
IA	INSTRUMENT AIR SUPPLY
IP	INSTRUMENT AND CONTROL POWER
LC	LEVEL CONTROLS, ALARMS AND GAGE GLASS
LH	LIMESTONE HANDLING
LL	LIGHTING
LS	REAGENT SLURRY FEED
MP	MAIN POWER
MPS	STATION VACUUM CLEANING
MPV	VACUUM CLEANSING UNIT
MS	MAIN STEAM
MST	STEAM TURBINE
MU	CONDENSATE MAKE-UP (UNIT)
MV	STATION CONDENSATE MAKE-UP TREATMENT
NT	NITROGEN
OF	FORCED OXIDATION SYSTEM
OH	CAUSTIC HANDLING
OL	LUBE OIL
OT	BEARING OIL TRANSFER AND PURIFICATION
PE	PRECIPITATOR
POC	PRE-OPERATIONAL CLEANING
PS	PROCESS SAMPLING

Code	Description
PW	POTABLE WATER
QFF	PULSE JET FABRIC FILTER
QPR	DRY ESP
QRW	WET FGD RECLAIM WATER SYSTEM
QSD	WET FGD
QV	AQCS VENTILATION SYSTEM
QWP	WET ESP
RD	ROOF DRAINS/PLUMBING
RS	SDRS REACTANT SUPPLY
SA	SERVICE (STATION) AIR
SB	SOOTBLOWING
SCR	SCR SYSTEM/AMMONIA
SD	SUMP PUMP DISCHARGE
SF	STATION SOFTENED WATER
SH	STATION HEATING
SLO	STATION LUBE OIL
SP	SUMP PUMP BEDPLATE, EQUIPMENT & MISC. FLOOR DRAINS
SS	AUTOMATIC GENERATION CONTROL
SS	SAMPLING (CYCLE WATER PURITY)
ST	SEWAGE TREATMENT
SV	EQUIPMENT SAFETY VALVE VENTS (INCLUDING BOILER VENTS)
SW	SERVICE WATER
SWA	ASH WATER (UNIT)
TCO	STEAM TURBINE HYDRAULIC CONTROL OIL
TD	TURBINE DRAINS
TDR	TURBINE CYCLE DRAINS
TG	TURBINE - GENERATOR AUXILIARIES
TO	TURBINE OIL
TOP	TURBINE OIL CLEANSING
TS	TURBINE SUPERVISORY
TSO	HYDROGEN SEAL OIL
TW	TREATED WATER
UHR	UNIT HEATING WATER RETURN
UHS	UNIT HEATING WATER SUPPLY
VB	BOILER ROOM VENTILATION
VC	CONTROL ROOM, AUXILIARY CONTROL EQUIPMENT ROOM VENTILATION
VJ	MACHINE SHOP VENTILATION
VK	? FACILITY VENTILATION
VM	MATERIAL HANDLING VENTILATION / DUST CONTROL
VS	SERVICE BUILDING HVAC
VV	MISC. VENTILATION
WA	ASH SLUICE WATER
WB	WASTE OIL
WC	CLOSED COOLING WATER
WD	DOMESTIC WATER
WG	GLAND WATER
WH	H.P. SERVICE WATER

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Code	Description
WK	MIST ELIMINATOR WASH WATER SPRAY
WM	MAKE-UP DEMINERALIZER
WN	GYPSUM STACK RECLAIM WATER
WO	CHILLED WATER

Code	Description
WS	SERVICE WATER
WT	COOLING TOWER WATER TREATMENT
WW	WELL WATER
XK	LIMESTONE DUST COLLECTION

3.4.5 Table 5.0 “PCI Database Fields”

FIELD NAME	DESCRIPTION
AP	Alarm Priorities (DIGITALS)
AS SHIPPED DIFFERENCES	This lists the database fields that were changed after comparing the as-shipped db with PCI db
BSCALE	Bottom Scale (AO's only) in Engineering Units
CARD_NAME	IO Module Name (assigned from IO Location)
CHARST	Characteristics provide a method for sorting the database based on plant area, signal, etc.
CHECKED	PCI Review
CHECKOUT COMMENTS	Comments During Checkout
COMMENTS TO EMERSON	Comments to Emerson
COMPARISON COMMENTS	EB to old HW db comparison
CONT_TYPE	Digital Outputs Only.
CONTACT STATE	NO for Normally Open or NC for Normally Closed
CONVTYPE	Set to "3" for flow inputs that require a square root operation (not differential
DB 1ST REVIEW CHG	This lists the database fields that were changed after conforming the first review material.
DEMO	Points removed from system
DESC	English description of I/O Point
DROP_ID	Originating Drop ID number; 1-254
ELEM DWG	Elementary Drawing Number or Electrical Schematic
EM COMMENTS	Emerson Comments and Concerns
ENGUNITS	Engineering Units (6 characters max)
FIELD_DESCRIPTOR	Field Assigned Descriptor
GROUND	Field, DCS, SB (Shield Bar)
H1V	High 1 Alarm Limits (HI)
H2V	High 2 Alarm Limits (HH)
H3V	High 3 Alarm Limits (HHH)
H4V	High 4 Alarm Limits (HHHH)
HOPRANGE	Engineering Range High (15 character max)
HP1	High 1 Priority
HP2	High 2 Priority
HP3	High 3 Priority
HP4	High 4 Priority
HW_IN_OUT	Input Output or SOE
INDEX	Unique Identifier (Also Emerson point alias)



FIELD NAME	DESCRIPTION
INSTRUMENT OR DEVICE NO	Instrument or Device Number
IO CABLE	IO Cable
IO CLOCATION	IO Cabinet Location (example 1CHS01F)
IO MODULE DWG	I/O Module Termination Drawing
IO SH	IO Card Termination for Shield Wire
IO_CARD_CAB	I/O Card Cabinet Number and Side (1CHS01F)
IO_CHANNEL	I/O Card Point
IO_LOC	IO Location; P.N.B.LL, P – PCI, N – Node, B – Branch or Crate, L – Location or Slot (Node only for Remote)
IO_TYPE	Field Designated I/O type
L1V	Low 1 Alarm Limits (LO)
L2V	Low 2 Alarm Limits (LL)
L3V	Low 3 Alarm limits (LLL)
L4V	Low 4 Alarm Limits (LLLL)
LOOP CHKD	Yes/No
LOOP CHKD BY	Initials of person who checked the loop
LOOP CHKD DATE	Date the loop was checked during outage
LOOP DWG	Instrument Loop Drawing Number
LOPRANGE	Engineering Range Low (15 character max)
LP1	Low 1 Priority
LP2	Low 3 Priority
LP3	Low 3 Priority
LP4	Low 4 Priority
M1 CAB	Marshalling Cabinet Location
M1 CABLE1	Marshalling Cable for Termination 1; From Marshalling
M1 CABLE2	Marshalling Cable for Termination 2; From Marshalling
M1 CABLE3	Marshalling Cable for Termination 3; From Marshalling
M1 CABLE4	Marshalling Cable for Termination 4; From Marshalling
M1 CLOCATION	Marshalling Cabinet and side;(DCS SIDE)
M1 DWG	Marshalling Cabinet Drawing
M1 SIDE	Marshalling Cabinet Side
MFT1 01	Marshalling Cabinet Field Termination 1;(FIELD SIDE)
MFT1 02	Marshalling Cabinet Field Termination 2;(FIELD SIDE)
MFT1 03	Marshalling Cabinet Field Termination 3;(FIELD SIDE)
MFT1 04	Marshalling Cabinet Field Termination 4;(FIELD SIDE)
MFT1 COLOR1	Marshalling Cabinet Field Termination 1; Color 1
MFT1 COLOR2	Marshalling Cabinet Field Termination 2; Color 2
MFT1 COLOR3	Marshalling Cabinet Field Termination 3; Color 3
MFT1 COLOR4	Marshalling Cabinet Field Termination 4; Color 4
MFT1 W1	Marshalling Cabinet Field Termination 1; Wire name
MFT1 W2	Marshalling Cabinet Field Termination 2; Wire name
MFT1 W3	Marshalling Cabinet Field Termination 3; Wire name
MFT1 W4	Marshalling Cabinet Field Termination 4; Wire name
MT1 01	Marshalling Cabinet Termination 1;(DCS SIDE)
MT1 02	Marshalling Cabinet Termination 2;(DCS SIDE)

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FIELD NAME	DESCRIPTION
MT1 03	Marshalling Cabinet Termination 3;(DCS SIDE)
MT1 04	Marshalling Cabinet Termination 4;(DCS SIDE)
MT1 COLOR1	Marshalling Cabinet Termination 1; Color 1;(DCS SIDE)
MT1 COLOR2	Marshalling Cabinet Termination 2; Color 2;(DCS SIDE)
MT1 COLOR3	Marshalling Cabinet Termination 3; Color 3;(DCS SIDE)
MT1 COLOR4	Marshalling Cabinet Termination 4; Color 4;(DCS SIDE)
MT1 W1	Marshalling Cabinet Termination 1; Wire name 1;(DCS SIDE)
MT1 W2	Marshalling Cabinet Termination 2; Wire name 2;(DCS SIDE)
MT1 W3	Marshalling Cabinet Termination 3; Wire name 3;(DCS SIDE)
MT1 W4	Marshalling Cabinet Termination 4; Wire name 4;(DCS SIDE)
NETWORK_ID	Network ID
LGE COMMENTS	LGE Comments and Concerns
PCI COMMENTS	PCI Comments and Concerns
PCI LOOP COMMENTS	Old Loop Sheet Comments
PCI LOOP COMPLETE	Old Loop Sheet Check
PID DWG	P&ID drawing number
PNAME	New Point Tagname
POWER	Field instrument power source FIELD,MARSH or DCS
POWER CKT	Power Circuit for Point
RED FLAG	Unresolved Problem
RESETDESC	0 State or False State (DIGITAL POINTS)
RESISTOR	New Resistor Kind if Needed
SAMA_DWG	SAMA Drawing
SETDESC	1 State or True State (DIGITAL POINTS)
STAT_CHK_T	0 = Alarm if 0 State; 1 = Alarm if 1 State; N = No Status Check
TM1	Terminal 1; IO Wiring, Signal Name/Location
TM2	Terminal 2; IO Wiring, Signal Name/Location
TM3	Terminal 3; IO Wiring, Signal Name/Location
TM4	Terminal 4; IO Wiring, Signal Name/Location
TM5	Terminal 5; IO Wiring, Signal Name/Location
TM6	Terminal 6; IO Wiring, Signal Name/Location
TM1 COLOR1	Terminal 1; Wire Color 1
TM2 COLOR2	Terminal 2; Wire Color 2
TM3 COLOR3	Terminal 3; Wire Color 3
TM4 COLOR4	Terminal 4; Wire Color 4
TM5 COLOR5	Terminal 5; Wire Color 5
TM6 COLOR6	Terminal 6; Wire Color 6
TSCALE	Top Scale (AO's Only) in Engineering Units
UNIT_ID	Unit ID
XMIT_DESC	Transmitter Description (4-20 MA AI, 4-20 MA AO, DRY CONTACT, etc.)
XMIT_DESC_PCI	Transmitter description RAW
XMITTYP	Transmitter Type (MA, TJ (T/C, J-type, etc.), RP (RTD, Platinum, etc.)

3.4.6 Emerson Required Fields for Initial Hardware

Point Name (PNAME)

Used for both ANALOG and DIGITAL points.

PNAME is a text field of from 1 to 16 characters. Point names ARE NOT case sensitive, however since lower case letters will be converted to upper case, it is recommended that all point names be input in upper case.

Characters A through Z and numbers 0 to 9 are all valid. DO NOT use the following special characters:

@ \$ % & * , \ ~ ' ` " . or space.

Description (DESC)

Used for both ANALOG and DIGITAL points.

DESC is a text field from 1 to 30 characters representing the English Description of the point.

This field should describe the "set" (or logical 1) status for digital points. For example, if the valve closed limit switch is "set" when valve X is closed, the DESC field should be "VALVE X CLOSED". This is recommended because the NT control builder automatically places these DESC fields on the control drawings.

Network ID (NETWORK_ID)

Used for both ANALOG and DIGITAL points.

It is not necessary to fill this field in, however it is required to define this field at the kickoff meeting or shortly afterward. This ID becomes part of the fully qualified point name. PWS requires that the network number be "0" and recommends that the network id (name) be "NETX". (x – Generally represents the unit number)

Input Output or SOE (HW_IN_OUT)

Used for both ANALOG and DIGITAL points.

Set this field to "INPUT" for all analog and digital inputs and "OUTPUT" for all analog and digital outputs. Should the digital input be a Sequence of Events point, place "SOE" in this field.

Transmitter Type (XMITTYP)

Used for ANALOG points only.

This field represents the type of analog signal that the point represents. Set this field to "ma" for 4-20ma, "TJ" for Type J T/C, "RP" for Platinum RTD, etc.

Transmitter Description (XMIT_DESC)

Used for both ANALOG and DIGITAL points.

For analogs, set this field to "4-20 MA AO" (or AI), "0-5 VT AI", "J Thermocouple", "RTD – 100 ohm Platinum", etc.

For digitals, set this field to "Dry Contact", "120 VAC Differential Input", "125 VDC Differential Input", "120VAC Digital Output with Relay Panel"

Power (POWER)

Used for ANALOG and DIGITAL points.

For 4-20 analog inputs, set this field to SELF or FIELD. All analog outputs, thermocouples and RTDs will be SELF. This field defines who is supplying the loop power.

For digitals, set this field to SELF or FIELD. This defines who is wetting the input/output contacts. As an example, "Dry contacts" would be SELF powered, while 125VDC wetted inputs will be FIELD powered. Generally, digital outputs are "FIELD" powered as most are wetted from the field. On occasion, some digital outputs require local loop powering and would be represented as "SELF" powered.

FIELD = field powered points.

SELF = DCS powered points.

High Operating Range (HOPRANGE)

Used for ANALOG points only.

Set this field to the high operating range of each input or output. This is required for all types of analog points. For thermocouples, this is used to select the proper thermocouple module.

Low Operating Range (LOPRANGE)

Used for ANALOG points only.

Set this field to the low operating range of each input or output. This is required for all types of analog points.

Ground (GROUND)

GROUND indicates whether the device is Field or Local ground. The database entry will be either FIELD or LOCAL.

Contact Type (CONT_TYPE)

Used for DIGITAL points only.

This field is used for DIGITAL OUTPUT points only. Set this field to 1_FORMC, 2_FORMC, FORMX, etc.

ANC_1 through ANC_80 are ASCII fields that can be used for any purpose required. As an example, customers may elect to use ancillary fields for P&ID number, transmitter tag, drawing numbers, etc.

3.4.7 Emerson Required Fields for Final Software

The Ovation database contains many options for alarming and historical functions.

For alarming, the following list provides those options that are typically used. It does not include

the more complex options (such as using alarm cutouts, using process points as alarm limits and dead bands, etc.).

The OPH Historian should be configured to scan points in the following manner.

Digital Points:

Scan frequency should be set to 1 sec by default. Other points can be specified on an individual basis.

Analog Points:

Scan frequency should be set to 1 sec by default. Deadband algorithm should be normally "STANDARD". Deadband should be set to "1" for points with operating ranges above 100. For operating range in the 10-100 use a deadband of "0.1". For operating ranges below 30, it should be "0.05".

The following DBID fields should be completed for all analog points. Some of the fields below should have already been completed as part of the hardware database submittal:

Engineering Units (ENGUNITS)

ENGUNITS is a text field from 1 to 6 characters. Set to "DEGF", "T/H", etc. If possible only use the first 4 characters (since the standard process point macros used in custom graphics use only the first 4 characters).

Low and High Operating Ranges (LOPRANGE, HOPRANGE)

Analog inputs only: Set these fields to the low and high operating range (in engineering units).

Conversion Type (CONVTYPE)

Set this field to a "3" for flow inputs that require a square root operation (point will be in units of flow, not differential pressure).

Bottom and Top Output Scales (BSCALE, TSCALE)

Analog outputs only. Set these fields to the minimum and maximum output value (in engineering units).

The following DBID fields are optional for analog points:

Alarm Limits

Low Alarm Limits (L1V, L2V, L3V, L4V), Priorities (LP1, LP2, LP3, LP4), and Deadband (LADB) V
 High Alarm Limits (H1V, H2V, H3V, H4V), Priorities (HP1, HP2, HP3, HP4), and

Deadband (HADB) V

Four sets of alarm limits are available. Set the limit field to the alarm limit value, and the priority field to the desired priority. It is recommended that priorities from 1 to 4 be used, where 1 is the most critical. The deadband field can be specified to prevent points from toggling in/out of alarm.

As actual point values reach the low or high alarm limits, they will be displayed on the alarm screen at the alarm priority chosen. As points values continue past the first alarm value to



others, they will alarm again, typically at a more critical alarm priority. By not placing any low or high alarm limits in the L1V or H1V fields, the point will not alarm.

The following DBID fields should be completed for all digital points:

Set and Reset Descriptions (SETDESC, RESETDESC)

These are text fields from 1 to 6 characters long. They provide a textual description of the corresponding SET (value = 1 or TRUE) and RESET (value = 0 or FALSE) for use in displays and reports.

The DESC field for digital points should describe the “set” state of the point. Therefore, it is recommended that the SET/RESET descriptions for these points be **YES/NO**.

The following DBID fields are optional for digital points:

Status Checking (STAT_CK_T) and Alarm Priority (ALMP)

Set the Status Checking field to define alarm checking as follows:

- N = No status checking (leave field blank)
- 0 = The point will go into alarm if its current value is 0
- 1 = The point will go into alarm if its current value is 1

Alarm Priority (AP)

Set the Alarm Priority field to the desired priority. It is recommended that alarm priorities from 1 to 4 be used, where 1 is the most critical. If the status checking field is left blank, the point will not alarm.

Characteristics (CHARST)

The same rules that apply to analog point characteristics will also apply to digital point characteristics.

3.4.8 Table 7.0 “System Ancillary Fields”

Field#	Attribute	Value	Information Source
ANC1	PNAME & DESCRIPTOR	3PT-BA013 FDF 3-1 DISC PSI	PNAME & DESC
ANC 2	Index Number		Project Database Index Number
ANC 3	Instrument ID		
ANC 4	OLD TAG	A036	OLD_PAIR1 OR OLD_PAIR2
ANC 5	Range & Eng. Unit	0-20 INWC	LOPRANGE / HOPRANGE / ENGUNITS
ANC 6	Point Type Description	4-20 MA AI	XMIT_DESC
ANC 7	Loop Power	Self	POWER
ANC 8	SETDESC / RESETDESC		SETDESC / RESETDESC
ANC 9	Point HDW Location	42_2.1.4_01	ORIGINATING DROP ID / IO_LOC_ADDRESS / IO_CARD_POINT
ANC10	I/O Point Terminations	P1(+)/A01 & A1(+)/B01	IO_TERM1 / IO_TERM2
ANC11	I/O Card Location	3405F	IO_CARD_CAB / IO_CARD_SIDE



Field#	Attribute	Value	Information Source
ANC 7	Loop Power	Self	POWER
ANC 8	SETDESC / RESETDESC		SETDESC / RESETDESC
ANC12	I/O Card DWG	E-34026	IO_MODULE_DWG
ANC13	I/O Card Model Number	5X00106G01/5X00109G01A	IO_CARD_NAME
ANC14	Field Cable Number	3TX016	NEW FIELD CABLE
ANC15	Field Cable Terminations	B & 1W	OLD_COLOR1 / OLD_COLOR2
ANC16	Marshalling Location	3405R TB01	MARSH CAB / M_SIDE / M_TB
ANC17	Marshalling Terminations	001 & 002	MFT1_1 / MFT1_2
ANC18	Marshalling DWG	E-34028	MARSH_DWG
ANC19	Instrument or Device Manuf & Model No	Rosemount	MANUF
ANC20	Instrument or Device Part No.	3051S1CA1A2F12A2AB2D1D2	MANUF PART NO
ANC21	P&ID	M-744-1	PID DWG
ANC22	Field Wiring DWG	E-3632	WIRING DWG
ANC23	Elementary DWG		ELEM DWG
ANC24	Device Location / or J-Box	J-BOX 3PL19K	DLOCATION
ANC25	Physical Device Location	AT EAST END OF FD FAN 3-1	PHY DEV LOC

3.5 Naming Conventions

3.5.1 Assigning Cabinet Numbering System

The cabinet numbering will increment from left to right when facing the identified "front" of the cabinet. The cabinet numbers will be used on the 32 character labels defined in this document.

The format of the DCS Cabinet Name will be as follows:

UNIT ID SYSTEM ID FUNCTION CODE SEQUENCE # SUFFIX
 0 DCS JCD 01 A

The format of any external Fiber Optic Patch Panels used for the DCS communications will be:

UNIT ID SYSTEM ID FUNCTION CODE SEQUENCE #
 0 DCS MX 100

UNIT ID

First Characters identify the Unit where:

- Common Equipment
(All Units)
- Unit 1 Equipment
- Unit 2 Equipment

SYSTEM IDENTIFIER

Second, third, and fourth characters are used as the System Identification Code. For DCS cabinets, the System Identifier will always be "DCS". Other examples can be found in "Exhibit X; APPENDIX-F: Trimble County Component Numbering", Section 3.3.



FUNCTION CODE

The fifth, sixth, and seventh characters identify the Function Code. The Function code for DCS Cabinets will always be "JCD". Other examples can be found in "Exhibit X; APPENDIX-F: Trimble County Component Numbering", Section 3.3.

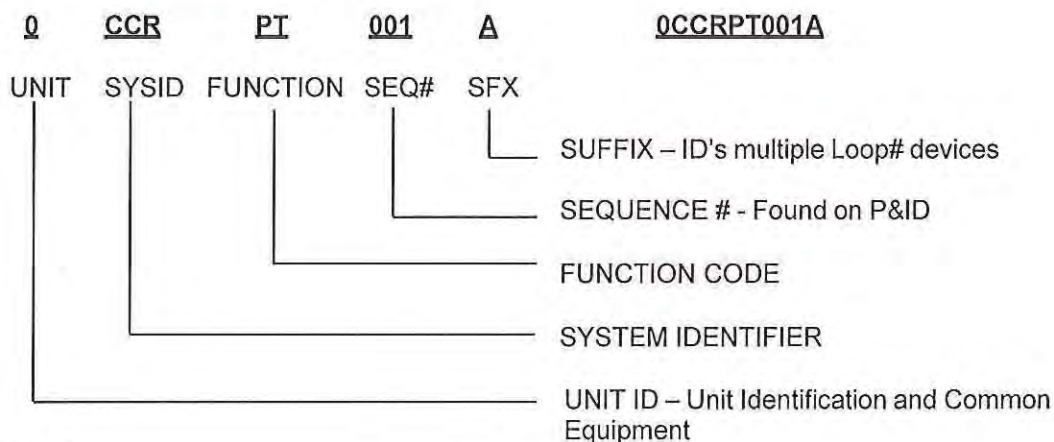
SEQUENCE NUMBER

The eighth and ninth characters identify the sequence number of the cabinet. The sequence number by default uses a two-digit number for DCS cabinets. A three-digit sequence number will be used for any external DCS Fiber Optic Patch Panels. Lower order numbers will be padded with leading zero's to maintain a standard length. For DCS cabinets, the main cabinet with processor and associated I/O cabinets will share a sequence number; and alphabetic suffix will be used to designate the Remote I/O and associated Termination Cabinets.

SUFFIX

For DCS cabinets, the suffix is used in conjunction with the sequence number. The main cabinet with processor and associated I/O cabinets will share a sequence number; and alphabetic suffix will be used to designate the Remote I/O and associated Termination Cabinets.

3.5.2 Instrument Numbering System



UNIT ID

First and Second Characters identify the Unit where:

- 0 = Common Equipment (All Units)
- 1 = Unit 1 Equipment
- 2 = Unit 2 Equipment

SYSTEM IDENTIFIER

Second, third, and fourth characters are used as the System Identification Code. For CCR Project, the System Identifier will "CCR". Other examples can be found in "Exhibit X; APPENDIX-F: Trimble County Component Numbering", Section 1.

FUNCTION CODE

The fifth, sixth, and seventh (if necessary) characters identify the Function Code. The Characters are used as a functional identification following the ISA convention where:

PT = Pressure Transmitter
 PI = Pressure Indicator
 PV = Pressure Valve
 LSH = Level Switch High
 PSL = Pressure Switch Low

Other examples can be found in "Exhibit X; APPENDIX F: Trimble County Component Numbering", Section 3.3.

SEQUENCE NUMBER

The eighth, ninth, and tenth characters identify the sequence number. Three digit number sequences are the normal practice for Power projects. Serial numbering shall be preferred in lieu of process variable parallel numbering. This ensures that all items within a loop have the same sequence number regardless of the leading process variable character in the Function Code. Lower order numbers shall be padded with leading zero's to maintain a standard length. See examples of Serial Loop Numbering below.

Numbering shall start at the primary measurement point and chain through the loop until it encounters the last element; e.g. valve, receiver, etc. or intersects another loop. When multiple sensors; e.g. three voting transmitters, are used to measure the same variable alpha suffixes shall be assigned to differentiate those sensors. Otherwise, independent sensors, e.g. separate transmitters for control and shutdown, shall be tagged with unique loop numbers.

Examples of Serial Loop Numbering

- *Redundant measurements: Differ only in suffix, e.g., three furnace pressure transmitters, 2-CB-PT-001A, 2-CB-PT-001B, 2-CB-PT-001C.*
- *Parallel equipment: Follow the mechanical equipment suffix designation, e.g., discharge pressure for two de-mineralizer feed pumps tagged 2-MU-MP-001A and 2-MU-MP-001B would have instrument tags 2-MU-PI-003A and 2-MU-PI-003B; for pumps tagged without suffixes, e.g., 2-MU-MP-004 and 2-MU-MP-005, use separate loop numbers without a suffix, e.g. 2-MU-PI-010 and 2-MU-PI-011.*
- *Multiple measurements for a single component: DO NOT use a common loop number with a suffix to differentiate between different measurements on the same component, e.g., instruments sensing suction and discharge pressure on a pump should have different loop numbers.*

SUFFIX

A suffix is used when a loop has more than one instrument with the same function code. Alphabetic, numeric or alphanumeric characters may be used but shall be implemented in a consistent manner. Preference should be given to the use of single alpha suffixes since it is the most common method.

3.5.3 I/O Point Naming (PNAME) System

Analog I/O Points

Analog I/O Point names are assigned by using the same convention as the Instrument Numbering System described in Section 3.5.2 (and Exhibit X Section 3 of APPENDIX-F Trimble County Component Numbering).

Digital I/O Points

Digital I/O Point names are assigned by using the same convention as the Instrument Numbering System described in Section 3.5.2 (and Exhibit X Section 3 of APPENDIX-F Trimble County Component Numbering). See Table 7.1 for additional Function Codes that are to be used with Digital I/O Point naming.

3.5.4 Table 7.1: Additional I/O Point Naming (PNAME) Information

TYPICAL DCS POINT NAME:

U SSS XXXXX ### Y	(NOTES 1 AND 2; 14 CHAR. MAX.)
U	UNIT NUMBER (COMMON=0; TC1=1; TC2=2; ETC.)
SSS	SYSTEM IDENTIFIER (Exhibit X, Appendix F, Section 1A)
XXXXX	FUNCTION CODE (Exhibit X, Appendix F, Section 3C); See extra codes below.
###	LOOP SEQUENCE NUMBER (Exhibit X, Appendix F Section 3D)
YY	LOOP SUFFIX (Exhibit X, Appendix F, Section 3E).

HARDWIRED INPUTS

<u>FUNCTION (NOTE 3)</u>	<u>DESCRIPTION (NOTE 4)</u>	<u>ONESTATE</u>	<u>ZEROSTATE</u>
		FUNCTION 1	FUNCTION 2
HS	HANDSWITCH (VARIOUS FUNCTIONS)	NA	NA
HC	HAND CONTROL STATION	NA	NA
LSH	LEVEL SWITCH HIGH	NO	YES
LSHH	LEVEL SWITCH HIGH HIGH	NO	YES
LSHHH	LEVEL SWITCH HIGH HIGH HIGH	NO	YES
LSL	LEVEL SWITCH LOW	NO	YES
LSLL	LEVEL SWITCH LOW LOW	NO	YES
LSLLL	LEVEL SWITCH LOW LOW LOW	NO	YES
PSH	PRESSURE SWITCH HIGH	NO	YES
PSHH	PRESSURE SWITCH HIGH HIGH	NO	YES
PSHHH	PRESSURE SWITCH HIGH HIGH HIGH	NO	YES
PSL	PRESSURE SWITCH LOW	NO	YES
PSLL	PRESSURE SWITCH LOW LOW	NO	YES
PSLLL	PRESSURE SWITCH LOW LOW LOW	NO	YES
VSH	VIBRATION SWITCH HIGH	NO	YES
VSHH	VIBRATION SWITCH HIGH HIGH	NO	YES
VSHHH	VIBRATION SWITCH HIGH HIGH HIGH	NO	YES
XA	TROUBLE ALARM	NO	YES
XE	CONTROL POWER AVAILABLE	YES	NO
YIR	MOTOR RUNNING INDICATION	YES	NO
YIS	MOTOR STOPPED INDICATION	YES	NO
YIO	VALVE TRAVELING OPEN	YES	NO
YIC	VALVE TRAVELING CLOSE	YES	NO
YIH	MOTOR RUNNING HIGH SPEED	YES	NO
YIL	MOTOR RUNNING LOW SPEED	YES	NO
ZSO	POSITION SWITCH/BREAKER OPEN	YES	NO
ZSC	POSITION SWITCH/BREAKER CLOSED	YES	NO

HARDWIRED OUTPUTS

<u>FUNCTION (NOTE 3)</u>	<u>DESCRIPTION (NOTE 4)</u>	<u>ONESTATE</u>	<u>ZEROSTATE</u>
JYO	POWER RELAY/SOLENOID ENERGIZE TO OPEN	YES	NO
JYC	POWER RELAY/SOLENOID ENERGIZE TO CLOSE	YES	NO
JYH	POWER RELAY START HIGH SPEED	YES	NO
JYL	POWER RELAY START LOW SPEED	YES	NO
JYS	POWER RELAY START COMMAND	YES	NO
JYP	POWER RELAY STOP COMMAND	YES	NO

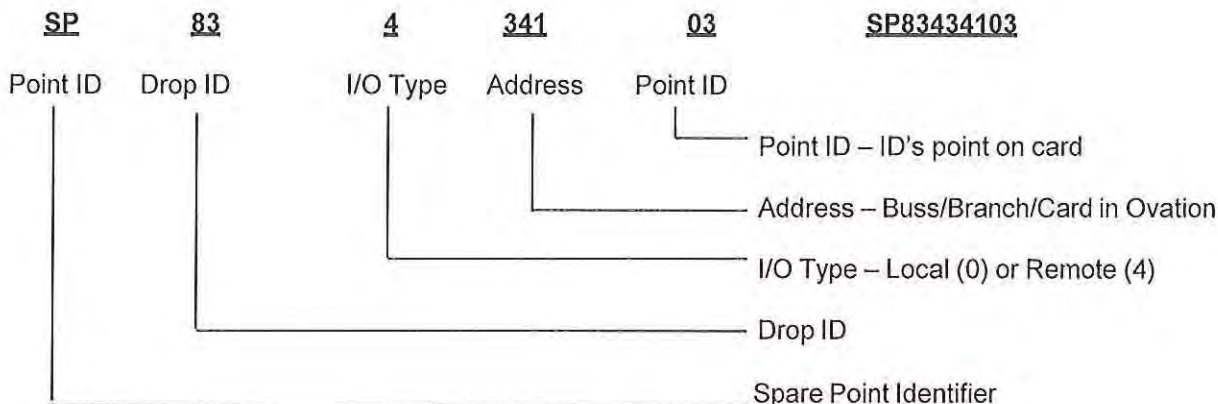
DCS DATA NETWORK POINT TAGGING CONVENTION

First Letter (Process Variable)	Succeeding Letters (Function ID's and Modifiers)				
	S (Note 6)	A (Note 5)	T (Note 7)	I (Note 8)	V (Note 9)
F (Flow)	SL	AL	T	I	V
	SLL	ALL			
L (Level)	SLLL	ALLL			
	SH	AH			
P (Pressure)	SHH	AHH			
	SHHH	AHHH			

NOTES for Table 7.1:

- DCS Hardwired INPUT and OUTPUT Point Names follow as closely to the actual PHYSICAL DEVICE TAGS as possible. For example, Flow Transmitter "0-CCR-FT-001" Input Point Name is "0CCRFT001." Internal POINT NAMES are based on Hardwired INPUT and OUTPUT Point Names as closely as possible. For example, if the flow is not compensated in the DCS, it remains "0CCRFT001"; If the Point is compensated in the DCS then the Point is labeled "0CCRFI001". Multiple INPUTS and OUTPUTS associated with the same device are labeled as closely to the Device Name as possible, using the FUNCTION CODE to identify the particular Point. For example, Pump "0-CCR-MP-001", the RUN COMMAND OUTPUT is "0CCRJYS001" and the RUNNING INPUT is "0CCRYIR001."
- No Dash, Space, or Underbar Characters are included in the DCS Point Name. It is a direct concatenation of the UNIT, SYSTEM IDENTIFIER, FUNCTION CODE, SEQUENCE LOOP NUMBER, and SUFFIX. However, the SEQUENCE LOOP NUMBER is padded with preceding zeroes, so that it is always three characters long. For example, "0CCRJYS004," not just "0CCRJYS4".
- Some of the characters used as modifiers in the "Function Codes" are not actual ISA letters; For example "S" for "START". Since no ISA equivalent is available, they have been assigned for clarity and consistency.
- The "Description Field" should clearly identify the functionality of each Input and Output Point.
- The "A" represents Internal Alarms which are generated from Transmitter Input Signals or Logic. (L=LOW and H=HIGH).
- The "S" Function Points are either Hardwired Points or Soft Event Points. Generally these points are multifunction, used for Control Interlock, and/or Alarm. (L=LOW and H=HIGH).
- The "T" is a Hardwired Analog Input Point and is maintained throughout the DCS Data Network unless the value is modified in the DCS Logic. Then it typically becomes an "I" point.
- The "I" represents a Computed Analog Value or a Modified (Compensated) Analog Input Point "I".
- The "V" represents an Analog Output Point, typically associated with a modulating Control Valve or Damper, denoted as "CV".

3.5.5 Spare Point Naming System (For Emerson Ovation)



Spare Point identification/tagging must be included in the project database, terminal drawings sheets, and internal card drawings.

3.5.6 Table 8.1 "System and Signal Type"

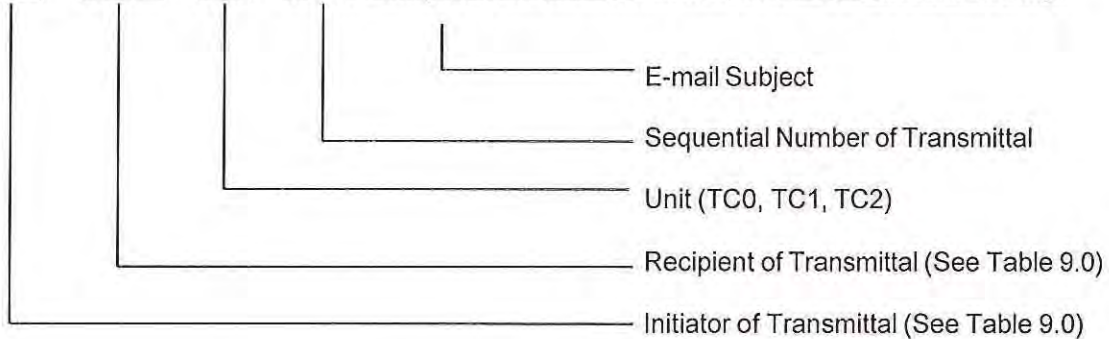
XXX	SYSTEM	ZZZ	SIGNAL TYPE
AIR	Air/Draft Systems	ALM	Alarm
ASH	Ash Handling System	AUT	Auto
AUX	Station Auxiliaries	BIA	Bias
AXB	Auxiliary Boiler	BYP	Bypass
BCP	Boiler Circulating Pumps	CFL	Calculated Flow
BFA	Boiler Feed Pump "A"	CLS	Close
BFB	Boiler Feed Pump "B"	COR	Correction
QFF	Pulse Jet Fabric Filter	CPW	Control Power
BLR	Boiler	DMD	Demand
BMS	Burner Management System	HI	High
CCR	Coal Combustion Residuals	LOW	Low
CEM	Continuous Emission Monitoring	LWI	Lower Inhibit
CND	Condensate System	MAN	Manual
COL	Coal System	MAX	Maximum
CWS	Circulating Water System	MIN	Minimum
DEA	Deaerator Control	MOD	Mode
ELC	Electrical Auxiliaries	OFF	Off/Stopped
EPS	Ethanol Plant Steam	ON	On/Running
EXH	Exhausters	OPN	Open
FDA	Forced Draft Fan "A"	OVL	Overload
FDB	Forced Draft Fan "B"	OVR	Override
FIR	Fire System	PER	Permissive
FUE	Fuel Supply System	PLW	Priority Lower
FUR	Furnace Pressure	PRA	Priority Raise
FWS	Feedwater System	RAI	Raise Inhibit
GEN	Generator	RST	Reset
GLY	Glycol System	SEL	Selected
GRF	Gas Recirculation Fans	STB	Standby
LRU	Lime Rail Unloader	STP	Stop
LDC	Load Demand Computer	SPT	Setpoint



XXX	SYSTEM	ZZZ	SIGNAL TYPE
LPS	Lime Prep System	STR	Start
PRI	Primary Air Controls	SVC	In Service
SEQ	Sequencer	TRP	Trip
SOE	Sequence of Events	XLM	Crosslimiting
SBS	Sootblower System		
SPD	Spray Dryer		
STM	Steam Temp Controls		
SUB	Substation System		
TUR	Steam Turbine		

3.5.7 Formal E-mail Correspondence Naming Convention Standard

PCI - LG&E - TC1 - XXXX. Subject of Transmittal PCI-LG&E-TC1-0053. Drawings

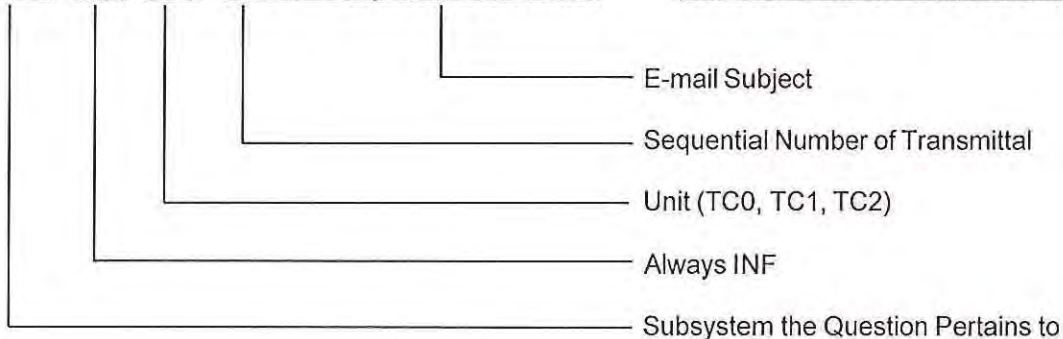


3.5.8 Table 9.0 "Transmittals"

Initiator of Transmittal / Recipient of Transmittal	
Abbreviations	Company Name
LG&E	Louisville Gas and Electric
PCI	Professional Consultants, Inc.
EM	Emerson
EPC	XXXXXX
B&M	Burns & McDonnell

3.5.9 Informal E-mail Correspondence Naming Convention Standard

CCR - INF - TC1 - XXXX. Subject of Transmittal CCR-INF-TC1- 0053. New Drawings



*Jan
AKR*

3.5.13 Table 12.0 “System Model”

Main Screen Graphic Numbers

Unit 0 = 1734-1758
Pop-Ups
Unit 0 = 17442-17558
Macros
Unit 0 = 60800-60899

LG&E will issue Emerson a block of numbers for Main Screens; Pop-ups, and Macros for all new projects.

Configuration

3.5.14 Historian Configuration

The EDB Historian should be configured to scan points in the following manner.

Digital Points:

Scan frequency should be set to 1 sec by default. Other points can be specified on an individual basis.

Analog Points:

Scan frequency should be set to 1 sec by default. Deadband algorithm should be normally “STANDARD”.

Deadband should be set to “1” for points with operating ranges above 100. For operating range in the 10-100 use a deadband of “0.1”. For operating ranges below 30, it should be “0.05”.

3.5.15 Alarm Configuration

Audible alarm stations for the main plant are: (to be updated by Emerson)

- Drop 212 – (Common) alarms 2 seconds after the alarm comes in.
- Drop 218 – (Unit 1) alarms 2 seconds after the alarm comes in.
- Drop 228 – (Unit 2) alarms 2 seconds after the alarm comes in.
- Drop 238 – (Combustion Turbines) alarms 2 seconds after the alarm comes in.

Standards for alarming points are as follows.

- Priority 1 – Emergency: (Blue) Any alarm resulting in a loss of a piece of equipment that causes a runback or Unit trip.
- Priority 2 – High: (Red) Any alarm which requires immediate operator action.
- Priority 3 – Low: (Orange) Any alarm which requires the operator to be notified of an off-normal condition.
- Priority 4 – Low: (Yellow) Information of event (i.e. Transmitter deviation and Valve and Breaker Position Failure alarms and Faults.
- Priority 5 – Not used
- Priority 6 – Not used
- Priority 7 – Not used
- Priority 8 – Not used





3.6 Ovation Characteristics

Each point in the Ovation System should be assigned a “Characteristic”. This will aid in alarming and filtering of points in numerous areas of the system. Please use the following convention: (EMERSON TO UPDATE)

- Plant Sub-System (AY field on Alarm screen)
- BCS – Boiler Control System
- TCS – Turbine Control System
- BMS – Burner Management System
- DAS – Data Acquisition
- SER – Sequence of Events Recorder

3.7 Master Cable Schedule

Prior to beginning any Database activities a Master Cable Schedule must be developed. The cable schedule provides the outline for all existing and new field cables affected by the DCS Upgrade. Each cable within scope must be listed in the cable schedule. All cables listed within the cable schedule will follow the standards identified in Tables 13.0, 14.0 and 14.1.

3.7.1 Table 13.0 “Master Cable Schedule Fields”

Index Field	Example
ID	Unique to each record
Unit #	One, Two
Cable Number	1AN034
PCI Code	Demo, Recon, Spare, New by Em, New by PCI
Checked	To be Completed by Subsystem PCI Designer only
Checked By	Initials of the person who checked the cable record
Tape Code	Cable are assign a tape code to identify scope (GN=DEMO, RD=CAB1)
Sub-System	BCS, DAS, SER, BMS, TCS, Etc.
Status	IN SCOPE, NOT IN SCOPE
From Location	Example: Annunciator Input Cab
SW From Drawing	10815-FE-7A
LG&E From Drawing	008-01-6-E-T-17A
New From Location	SER01 F/T TB02
New From Drawing	E-1SER01-01
To Location	PS-35 NR XMTR RACK "K"
To Drawing	E-1234
Entry	Top, Bottom
NO/COND/SIZE	1-2-12
Type of Cable	Vendor supplied, XLPE, Etc.
Length	550'
Comments	As Applicable
Cable Tag Size	½, ¾, 1, Etc.
Conductor Sleeve Size	½, ¾, 1, Etc.

3.8 Cable Number Standards

All Unit X existing Cables (Owners) will keep their existing cable numbers. The following is an example of an extension cable. Please see Table 14.0 and 14.1 for assigning new cable numbers.



3.8.3 Table 14.1 “New External Cable Number Standards”

XYYYNNNN Example: 1CCR0001 X = Unit ID (0,1,2,3,4,5,6,7,8,9,"A" for Unit 10. 10 in Hexadecimal is "A"). YYY = Sub-System Acronym Code NNNN = Cable Number 0-9999	
Sub-System Cable Codes	
XCOM0000 = Common / Miscellaneous (COM)	XDAS0000 = Data Acquisition (DAS)
XCHS0000 = Coal Handling (CHS)	XSBS0000 = Soot Blower System (SBS)
XLHS0000 = Limestone Handling (LHS)	XAHB0000 = Bottom Ash Handling (AHB)
XWTS0000 = Water Treatment (WTS)	XFAS0000 = Boiler Fly Ash Handling (FAS)
XBCS0000 = Boiler Controls (BCS)	XSCR0000 = Selective Catalytic Reduction (SCR)
XBMS0000 = Burner Management (BMS)	XQPR0000 = Dry Electrostatic Precipitator (QPR)
XTCS0000 = Turbine Controls (TCS)	XQWP0000 = Wet Electrostatic Precipitator (QWP)
XBOP0000 = Balance of Plant (BOP)	XQFF0000 = Pulse Jet Fabric Filter (QFF)
XCTG0000 = Gas Combustion Turbine (CTG)	XFGD0000 = Sulphur Dioxide Removal (FGD)
XCCR0000 = Coal Combustion Residuals (CCR)	

Cables from the DCS Marshalling Terminals to the field devices or equipment are considered External Cables.

3.9 Typical Wiring Examples

Figure 1.0 "120VAC Marshalling Terminal Block Design Example"

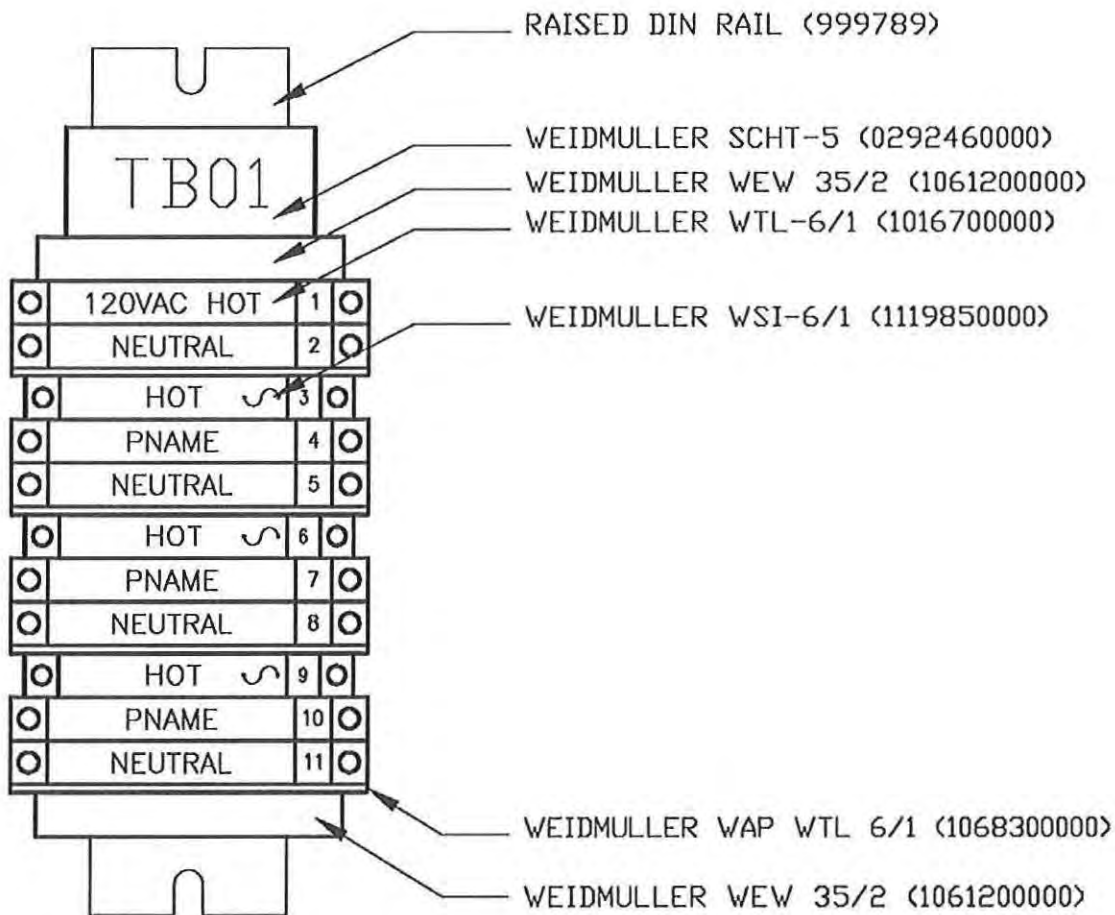
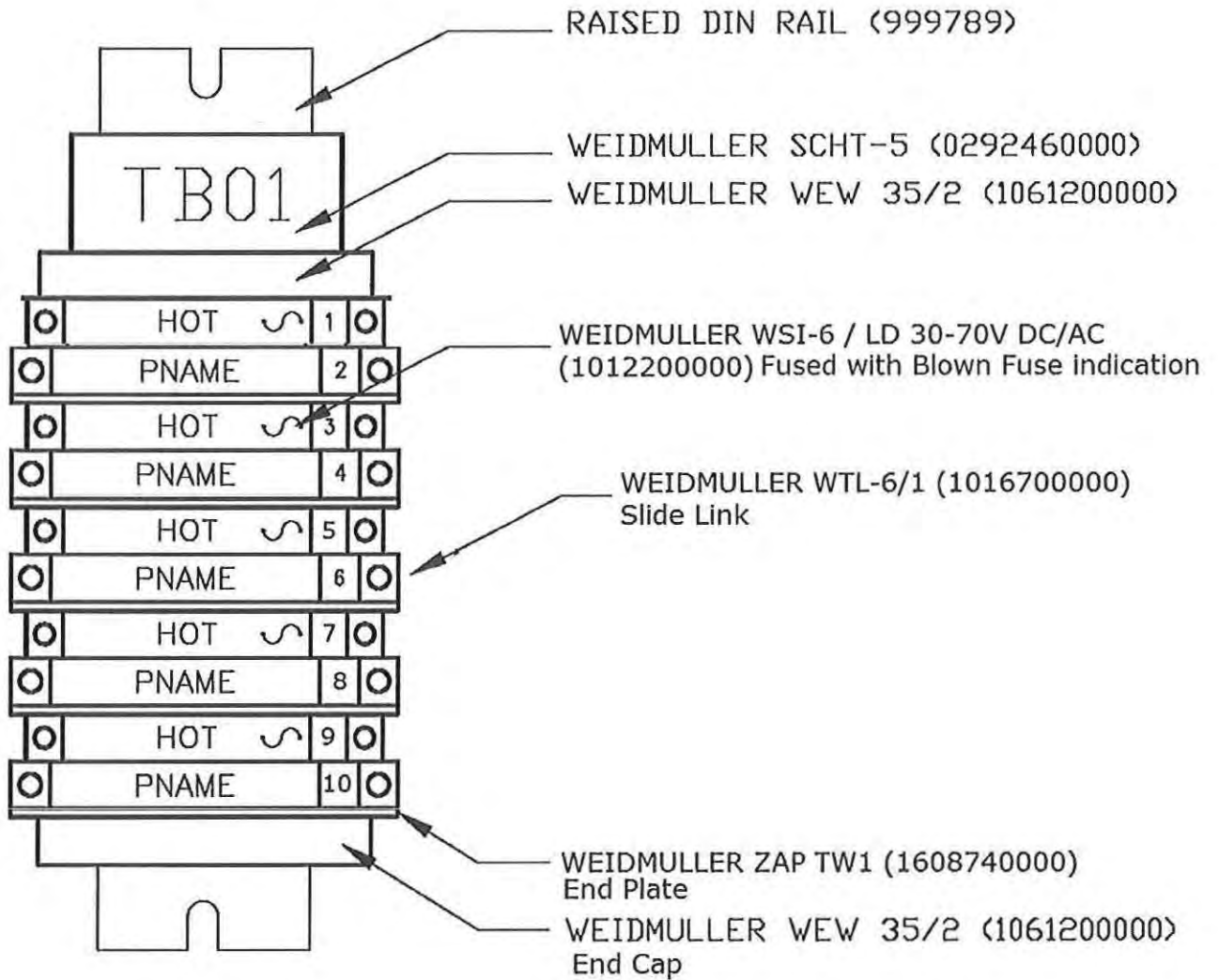


Figure 1.1 “48VDC Marshalling Terminal Block Design Example”



***** Note: Use 250 mA fuses for 48 VDC Digital Inputs. *****

Figure 2.0 "Analog Wiring and Cable Documentation/Termination Example"

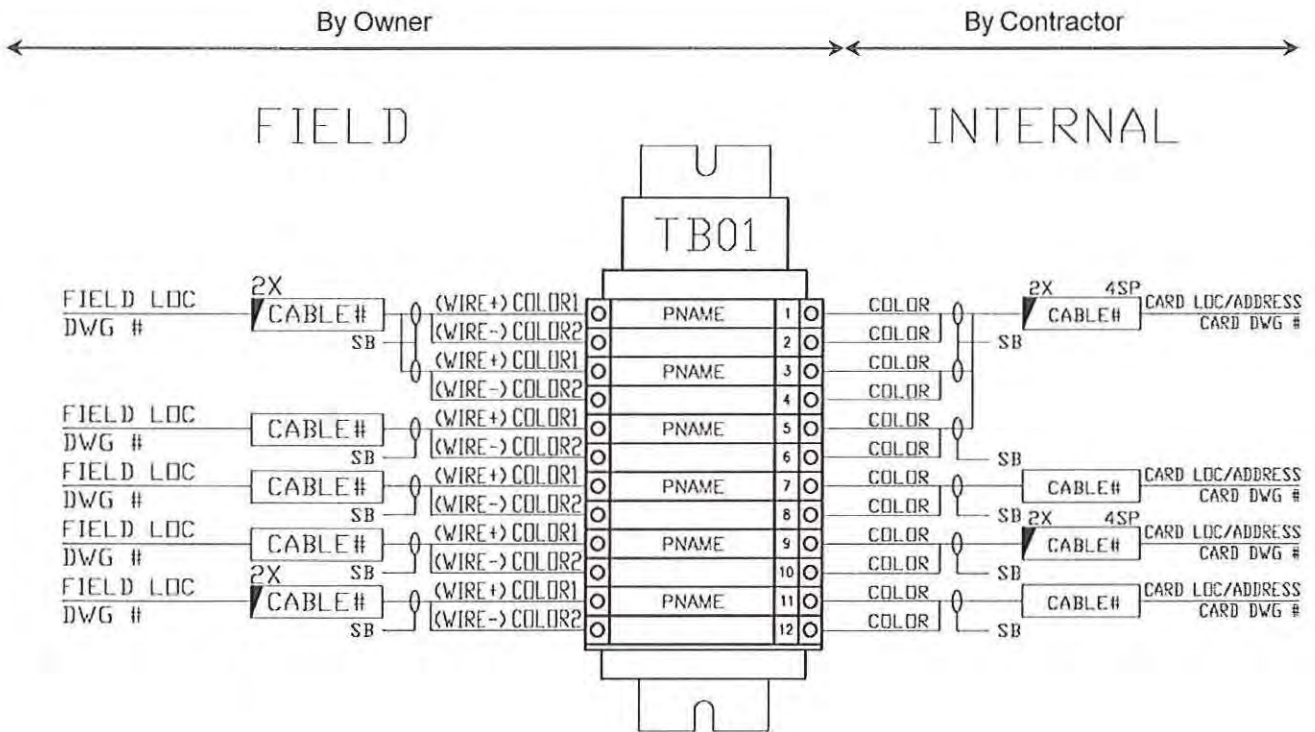


Figure 3.0 “4-20mA AI Wiring Termination Example”

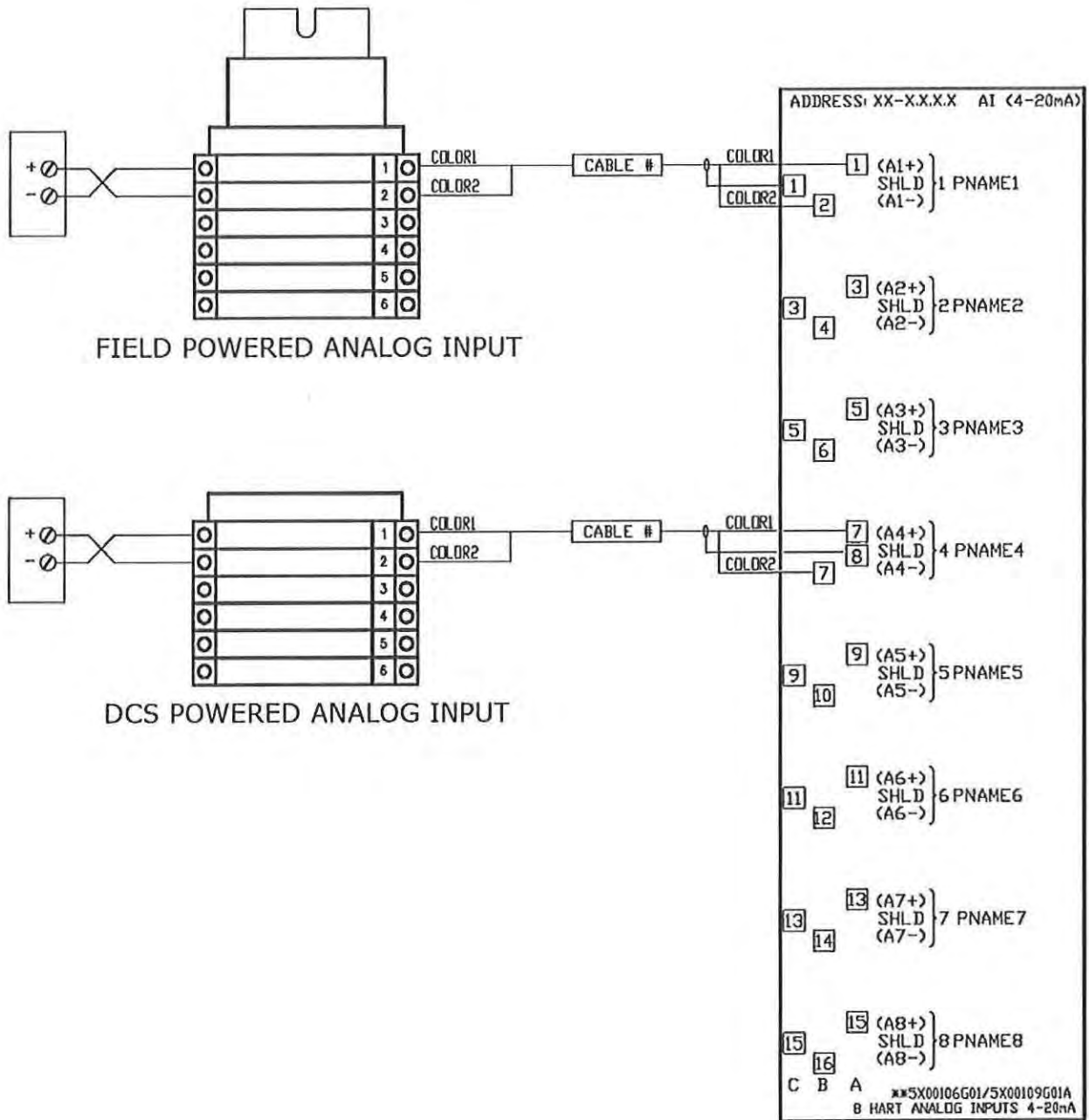


Figure 4.0 “120VAC DI Wiring Termination Example”

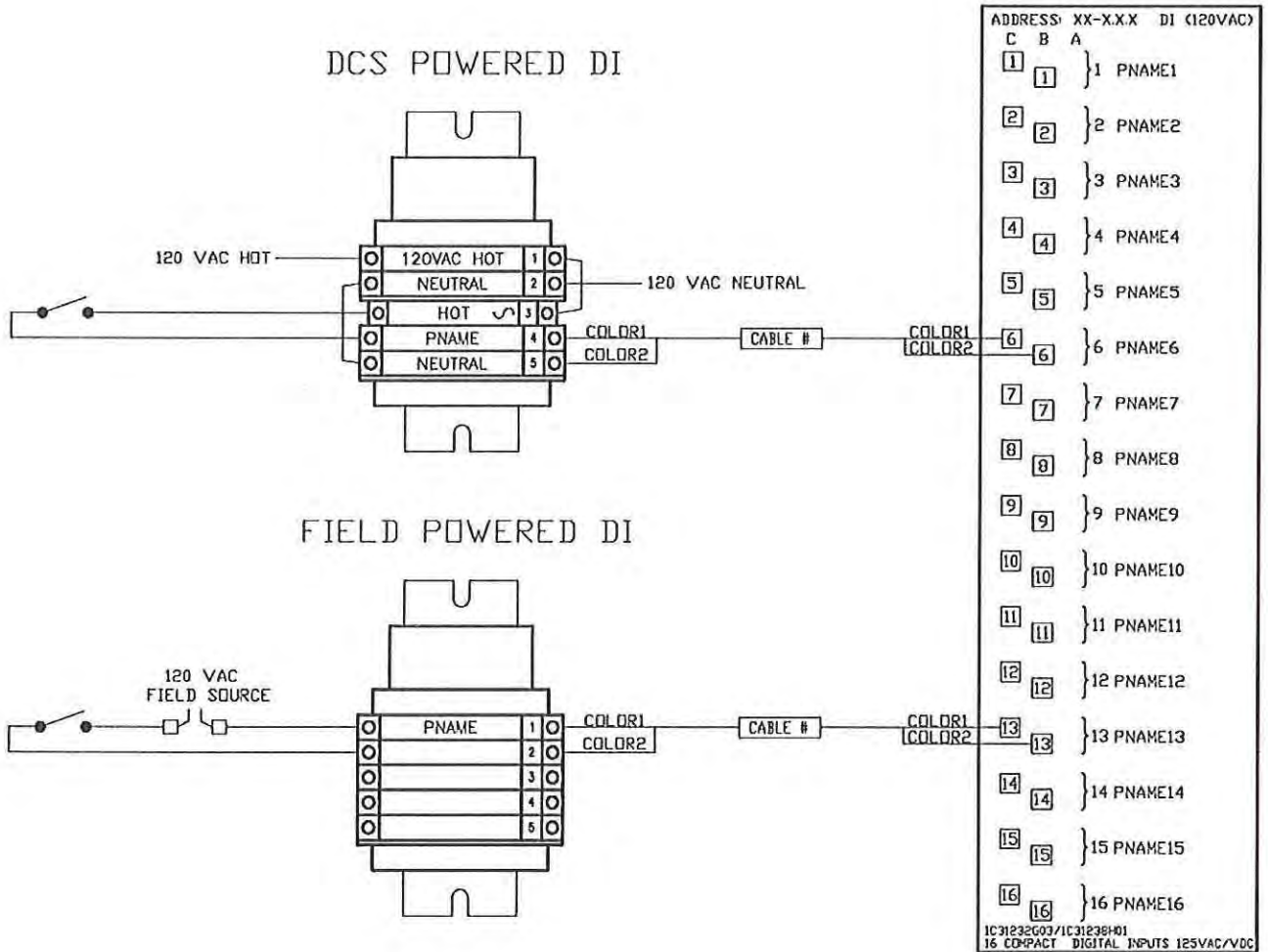
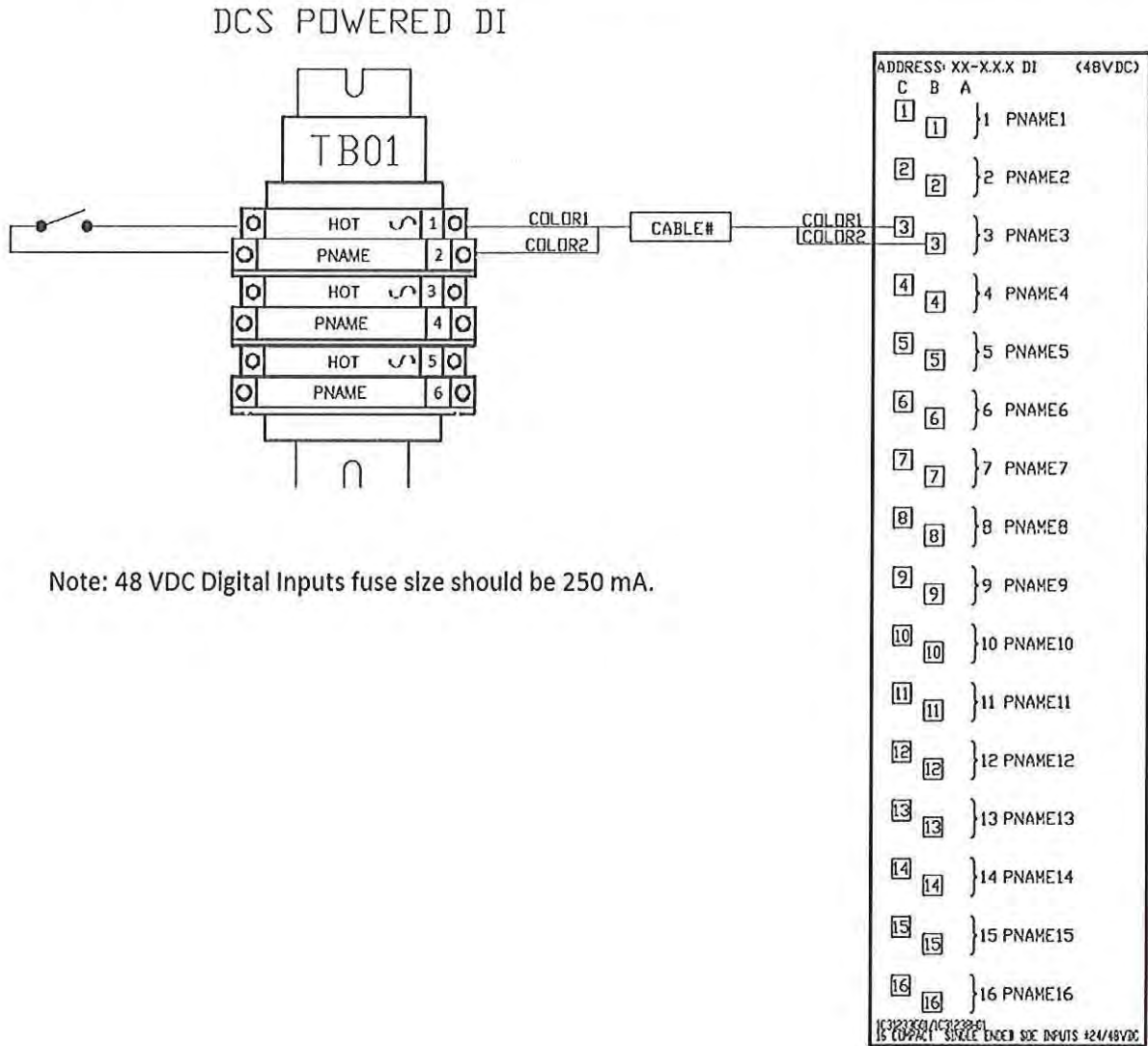


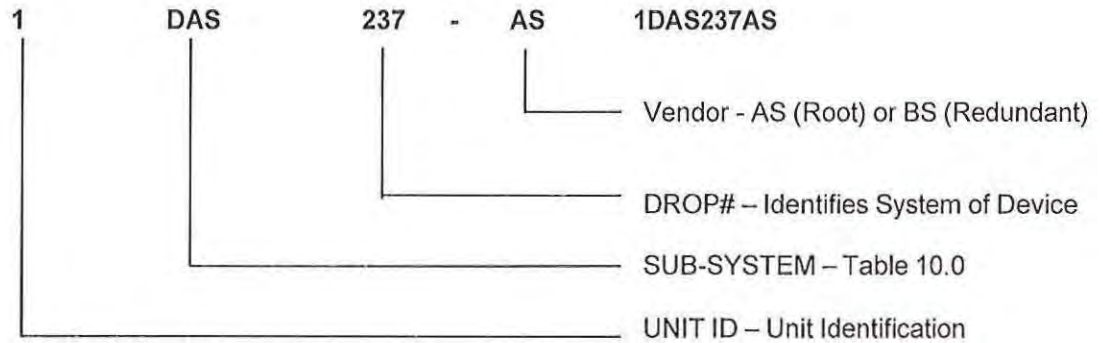
Figure 5.0 "48VDC DI Wiring Termination Example"



Note: 48 VDC Digital Inputs fuse size should be 250 mA.

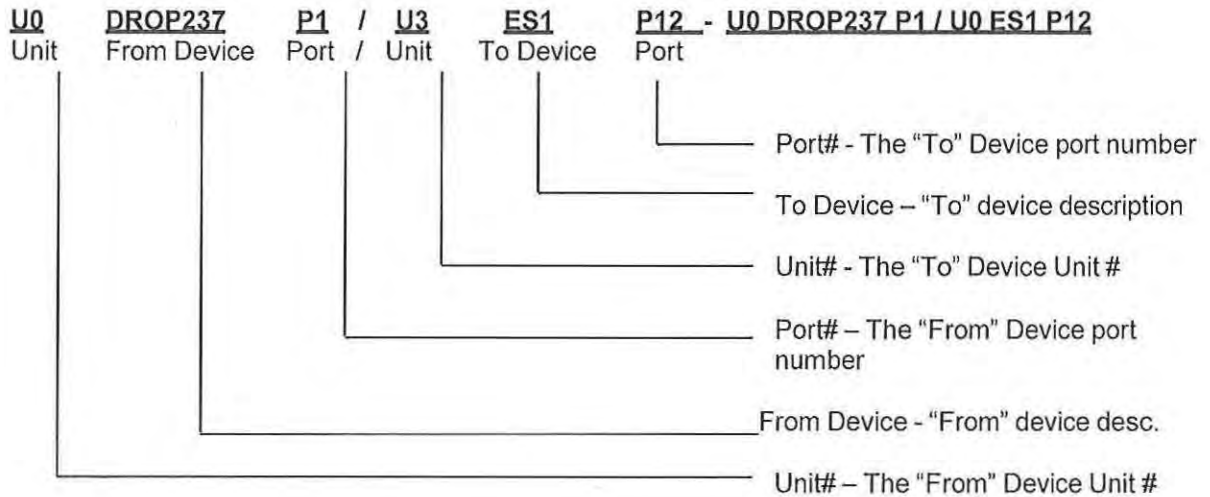
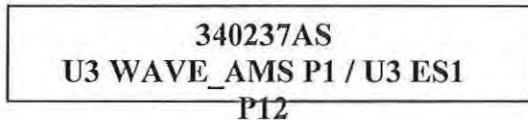
3.10 Cable Marker and Wire Sleeves

Communication Cable Numbering Scheme



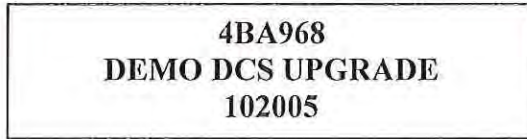
Communication Cable Marker Example

The following shrinkable label (1/2") will be utilized for all Networks (Fiber, Ethernet, coax, phone, etc...) for this project upgrade. The label must have a white background. The label must use permanent black ink. The first line is the cable#, the second line is the From/To information. See below for an example of the wire label. The "To" side is always the network cabinets. If it's a switch to switch cable, the lower number via alphabetically then numerically, is the "To" side.



Demo Cable Marker Example

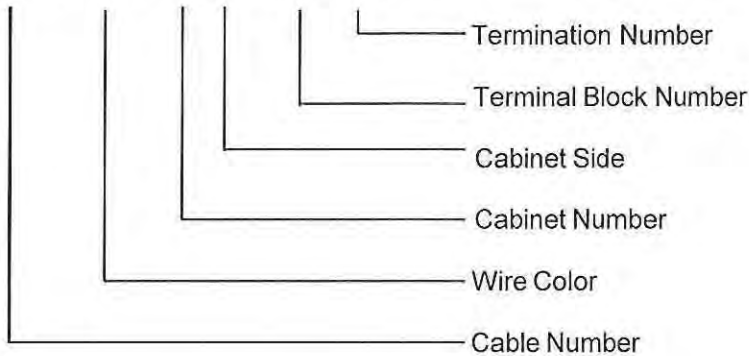
The following label (1"x4") will be utilized for all cables removed for this project upgrade. The label must have a white background. The label must use permanent black ink. The label must be wrapped with clear tape for protection. The first line is the cable#, the second line is text that reads "DEMO DCS UPGRADE" and the third line is the date in xxyyyy format. See below for an example of the wire label.



Field Wiring Sleeve Example

The following describes the conventions used for the 32 character wiring labels both on new and existing field cables and wiring lifted and landed in any of the junction boxes or cabinets.

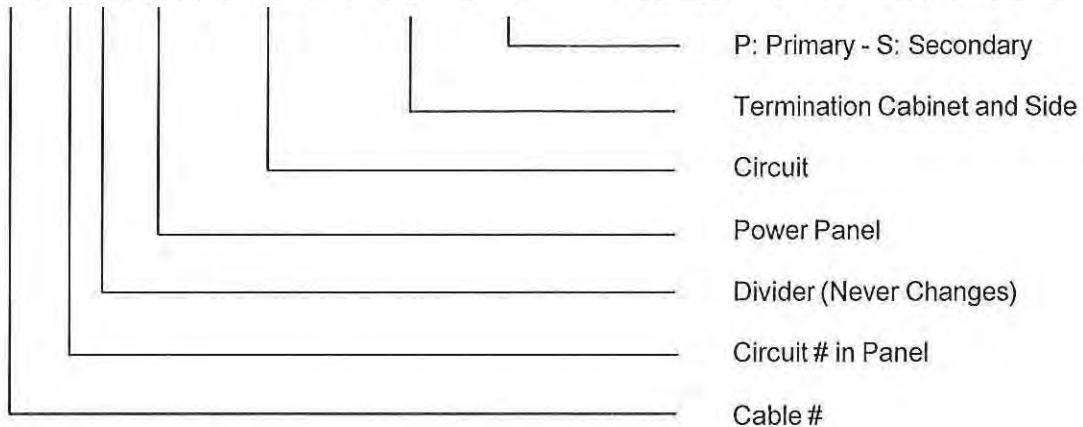
1AHS01F U * 3403R TB05 - 100



Power and Grounding Wire Sleeve Example

The following describes the conventions used for the 32 character wiring labels both on new power and grounding cables and wiring lifted and landed in any of the junction boxes or cabinets.

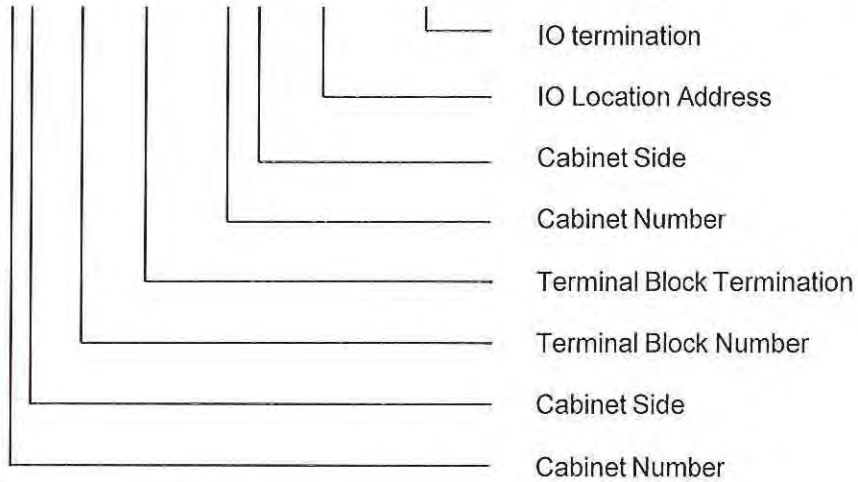
25170 B * PP2A - CKT1H / 2402F - P 25170 B * PP2A-CKT1H/2402F-P



Internal Wire Sleeve Example

1AHS02R TB05-100 / 1AHS01F 2.2.8-10(-)/B10

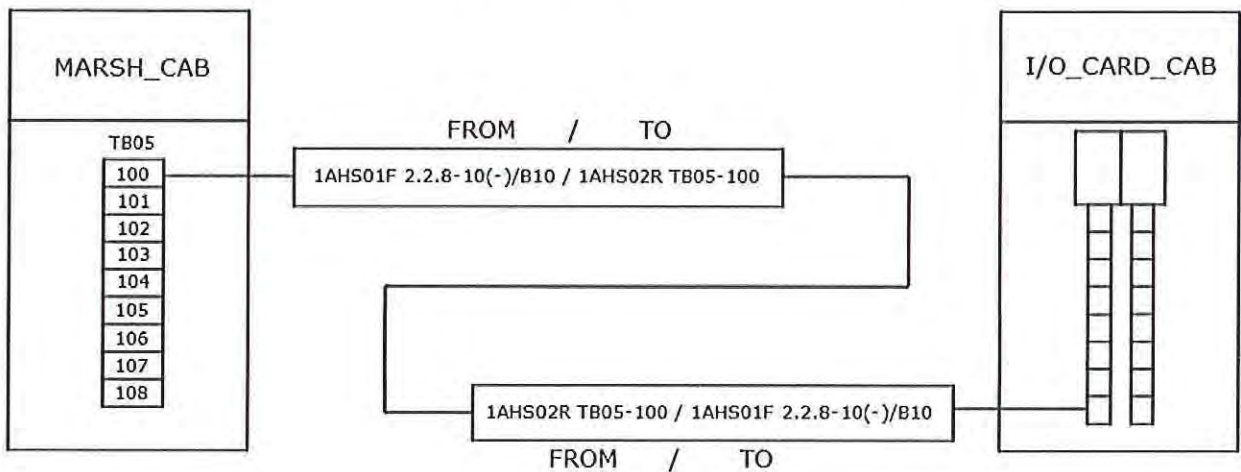
1AHS02R TB05-100 / 1AHS01F 2.2.8-10(-)/B10



Database Field Equivalent

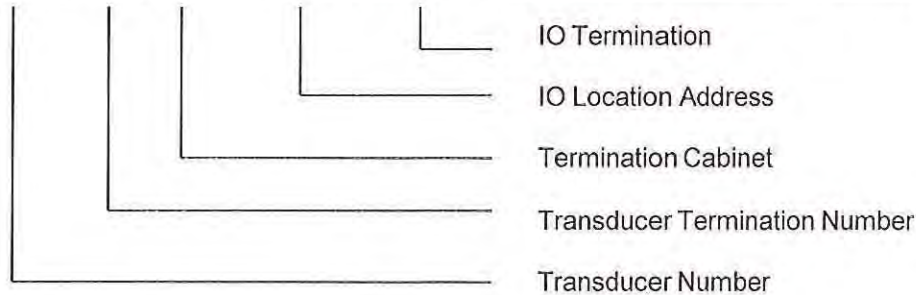
- IO Termination: (IO_TERM1, IO_TERM2, IO_TERM3 or IO_SH) IO
- Location Address: (IO_LOC_ADDRESS)
- Cabinet Side: (M_SIDE OR IO_CARD_SIDE)
- Cabinet Number: (MARSH_CAB OR IO_CARD_CAB)
- Terminal Block Termination: (MT1_1, MT1_2, MT1_3, MT1_4, MFT1_1, MFT1_2, MFT1_3, MFT1_4)
- Terminal Block Number: (MTB)
- Cabinet Side: (IO_CARD_SIDE OR M_SIDE)
- Cabinet Number: (IO_CARD_CAB OR MARSH_CAB)

Figure 8.0 "Sample Wire Sleeve Diagram"



Transducer Wire Sleeve Example (XDCR to EM I/O at EM I/O)

XDCR01-001 / 1DAS01F 2.2.8-10(-)/B10 XDCR01-001 / 1DAS01F 2.2.8-10(-)/B10

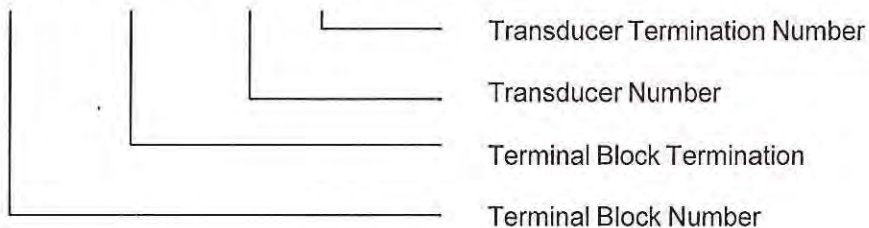


Database Field Equivalent

IO Termination: (TM1, TM2, TM3, TM4, IO SH)
 IO Location Address: (IO_LOC)
 Termination Cabinet: (IO_CARD_CAB)
 Transducer Termination Number: (From Drawing)
 Transducer Number: (From Drawing)

Transducer Wire Sleeve Example (Marshalling to XDCR at

XDCR) 01RTB01-100 / XDCR03-003,01RTB01-100 / XDCR05-001



Database Field Equivalent

Terminal Block Number/Termination: (MT1 01, MT1 02, MT1 03, MFT1 01, MFT1 02, MFT1 03)
 Transducer Termination Number: (From Drawing)
 Transducer Number: (From Drawing)

4.1 Design Process

4.2 Phase 1 – Preliminary Design – (PCI/Owner)

4.2.1 Create Hardwired I/O Database:

Utilizing data gathered during the field verification, PCI will identify all existing hardwired I/O that will be brought into DCS controls. This database shall include all existing points and the information associated with its existing layout. Each column is defined in the PCI database fields (Table 5.0 "PCI Database Fields" found in this Engineering Standards Document.

4.2.2 Preliminary Engineered I/O Database:

PCI shall integrate all of the required I/O into the new layout. This portion of database creation includes preliminary point names, ranges, signal types, descriptions, new cabinet layout and information, and any other initial database records that are required for EM for I/O partitioning.

4.2.3 Preliminary Drawings:

PCI shall develop CAD drawings of the new layout in accordance with the Engineered I/O database. These marshalling prints shall be reviewed and approved by the Owner. The details associated with the marshalling standards shall be discussed and approved during the Engineering Standards Document phase.

4.2.4 Owner Review of Preliminary Database & Drawings:

Once the preliminary database and drawings are completed, they will be turned over to Owner for review and approval. Once this review is complete, the Owner shall submit the reviewed copy back to PCI to incorporate these changes.

4.2.5 SharePoint Posting:

Once the Owner changes are incorporated in the Drawings & Database, they will be posted to SharePoint for Transmittal to EM. The drawings are placed in the "UX Factory Wiring Drawings" Document Library on SharePoint. The databases are placed in the "Databases" Document Library on SharePoint. Table P1 indicates the records that are required to be in the Master Database submitted to EM.

4.2.6 Ready for I/O Partition Notification:

PCI shall notify EM (via formal e-mail correspondence) that the drawings and I/O database are ready for I/O partitioning. PCI will also notify EM of the SharePoint location of the files.

4.3 Phase 2 – I/O Partitioning – (EM)

4.3.1 Partition I/O Database:

EM shall checkout the Database (The PCI database will be zipped and the file name will be "XXX PCI DB.zip" where XXX indicates the subsystem (BCS, BMS, CHS ...). EM will take the point information from the PCI master database and build and partition their DBID database. EM control engineers shall properly partition all I/O and include spares to meet the project specifications and provide a safe control design. Table P2 indicates the records that are required to be in the DBID Database submitted to PCI for their review.

*Note: if additional indexes are required for partitioning EM will send a request via e-mail. This request simply needs to contain the amount of indexes needed and which subsystem they are needed for. PCI will assign a block of additional indexes and submit to EM.

4.3.2 Hardware Assembly Drawings:

EM shall review the cabinet Drawings from SharePoint for the subsystem they are creating a hardware layout for. Based on the amount of I/O hardware required for the partitioned database and the space available in the cabinet complex, EM will build the hardware assembly package.

*Note: if additional space is required for hardware, EM will send a request via e-mail. EM and PCI will work towards a mutually agreed upon hardware layout solution.

4.3.3 SharePoint Posting:

Once EM has built the DBID database, it will be posted to SharePoint for Transmittal to PCI. The DBID database will be placed in the "Databases" Document Library on SharePoint. The DBID database will be zipped and the file name will be "XXX DBID DB" where XXX indicates the subsystem (BCS, BMS, CHS...).

EM shall check-in the "XXX PCI DB.zip" where XXX indicates the subsystem (BCS, BMS, CHS ...).

The Hardware Assembly Drawings will be submitted to PCI via formal e-mail for PCI's review of the I/O card layouts.

4.3.4 Ready for I/O Partition Review Notification:

EM shall notify PCI (via formal e-mail correspondence) that the XXX DBID DB.zip database is ready for I/O partitioning Approval.

4.4 Phase 3 – I/O Partitioning Approval – (PCI)

4.4.1 Review of Partitioned Database and Drawings:

PCI will checkout both the DBID and the PCI databases from SharePoint to indicate that PCI is working with the Databases. PCI and the Owner will review the partitioning of the database. In the event that changes need to occur to the DBID database, the changes required will be communicated via e-mail or phone conference. PCI will check in the DBID database to allow EM the ability to check out the DBID database, make their changes, and check the file back in. This review process will occur until the DBID partitioning is approved.

4.4.2 Approved I/O Partition Notification:

PCI shall notify EM (via formal e-mail correspondence) that the "XXX DBID DB" database I/O partitioning is approved.

4.4.3 Approved Hardware Assembly Notification:

PCI shall notify EM (via formal e-mail correspondence) that the hardware assembly drawings are approved.

4.4.4 Integration of I/O Partitioning and Spares:

Once PCI and the Owner have approved all aspects of I/O partitioning and the hardware assembly drawings, PCI will import the Table P2 records from the DBID db and the spare points into the "XXX PCI DB". Once this is complete, PCI will create a new database called "XXX IFWC DB". This will be the database that CSM will work from.

4.4.5 Ready for I/O Wiring:

PCI shall notify EM (via formal e-mail correspondence) that the "XXX IFWC DB" database is ready for I/O wiring.

4.5 Phase 4 – I/O Partitioning Drawings & Database – (CSM)

4.5.1 CSM Incorporate Internal Wiring Database and Drawings:

CSM will need to check-out the “XXX IFWC DB”, and the subsystem drawings. CSM will incorporate the I/O wiring onto the Factory wiring prints and will update the records in the “XXX IFWC DB” shown in Table P3. Once completed, CSM will check-in all documents.

4.5.2 Ready for I/O Wiring Drawing and db Check:

EM shall notify PCI (via formal e-mail correspondence) that the “XXX IFWC DB” database and the factory wiring drawings are ready for I/O wiring review.

4.6 Phase 5 – I/O Cabinet Construction Database and Drawing Approval – (PCI)

4.6.1 Final Approval for EM Cabinet Construction:

PCI will review the Factory Wiring Drawings and the “XXX IFWC DB” database. This review will consist of a line by line, point by point review of the system. The review process will flow as follows:

PCI will create a red-line set of the Factory Wiring drawing changes.

Upon review completion, PCI will submit the drawings to CSM for correction.

PCI will check the drawings in for CSM to correct.

CSM will check out the drawings and make the redline corrections. It will be the responsibility of CSM to verify that the PCI markups are made correctly on the CAD drawings. If there are questions concerning the PCI markups, PCI will be available for assistance.

Once CSM is completed with the corrections, CSM will check the drawings back into SharePoint.

*Note: PCI will maintain all corrections to the “XXX IFWC DB” database during this process.

4.6.2 Ready for I/O Cabinet Construction:

PCI shall notify EM (via formal e-mail correspondence) that the “XXX IFWC DB” databases and drawings are approved for I/O Cabinet Construction.

4.7 Phase 6 – I/O Cabinet Construction – (CSM)

4.7.1 CSM Cabinet Construction:

CSM will be responsible for constructing the cabinet complexes, wiring the marshalling, all cable and conductor labeling, and shipping the cabinet to Emerson.

*During the CSM portion of the cabinet construction, EM shall be responsible for communicating any changes that may need to occur during construction. PCI shall be available for any assistance required by EM during this phase.

4.7.2 EM Cabinet Construction:

EM will be normally responsible for wiring the I/O terminations, quality control, and preparing the cabinet for I/O wiring checkout by PCI/Owner.

*During the EM portion of the cabinet construction, EM shall be responsible for communicating any changes that may need to occur during construction. PCI shall be available for any assistance required by EM during this phase.

4.7.3 Ready for I/O Checkout:

EM shall notify PCI (via formal e-mail correspondence) that the Cabinet Construction is complete and submit a "XXX DBID DB" database that will be used for I/O checkout on SharePoint.

4.8 Phase 7 – Emerson Shop Floor Testing – (EM)

4.8.1 Small Changes Up to FAT:

Once the cabinets have been constructed, small changes may need to occur to both the PCI and DBID database as well as the drawings. These small changes will be handled with formal e-mail utilizing Table P4. All parties will need to maintain their databases and documents as appropriate.

4.9 Phase 8 – Post FAT – (EM/PCI)

4.9.1 Ready for Final Review:

Once the I/O wiring check and FAT have been completed by the Owner and PCI, EM shall notify PCI (via formal e-mail correspondence) that the FAT is complete and submit a "XXX DBID DB" database that will be used for final integration on SharePoint.

*It is important that PCI is made aware of the records in the DBID database that contain true information.

4.9.2 Final Review of Database and Drawings:

PCI shall complete a full review of the database and drawings to ensure that all items associated with the system have been integrated properly. This is the final review of the database and drawings before they are issued for construction.

4.9.3 Final Ancillary Database:

Owner, PCI, and EM shall define how the ancillary fields shall be developed during the creation of the engineering design document. Upon completion of this final review, PCI shall supply EM with the most current ancillary field information for EM to install into the field system ancillary fields as the engineering document requires. PCI will supply each individual record information and EM will combine these records as required to install them into the ancillary fields.

4.9.4 Issued for Construction:

Upon completion of this final review, the drawings and database shall be "Issued for Construction". This "Issued for Construction" database shall be used to develop and create the final checkout packages for the system. The "Issued for Construction" drawings shall be prepared and printed for the PCI Construction manager to distribute to the Electrical contractor.



4.9.5 Table P1 “Minimum Records Sent to EM for I/O Partitioning Submittal”

FIELD NAME	DESCRIPTION
COMMENTS TO EMERSON	Comments to Emerson
CONT_TYPE	Digital Outputs Only.
CONTACT STATE	NO for Normally Open or NC for Normally Closed
DESC	English description of I/O Point
ENGUNITS	Engineering Units (6 characters max)
GROUND	Field, DCS, SB (Shield Bar)
HOPRANGE	Engineering Range High (15 character max)
HW_IN_OUT	Input Output or SOE
INDEX	Unique Identifier (Also Emerson point alias)
LOPRANGE	Engineering Range Low (15 character max)
M1 CAB	Marshalling Cabinet Location
M1 DWG	Marshalling Cabinet Drawing
M1 SIDE	Marshalling Cabinet Side
MFT1 01	Marshalling Cabinet Field Termination 1;(FIELD SIDE)
MFT1 02	Marshalling Cabinet Field Termination 2;(FIELD SIDE)
MFT1 03	Marshalling Cabinet Field Termination 3;(FIELD SIDE)
MFT1 04	Marshalling Cabinet Field Termination 4;(FIELD SIDE)
MFT1 COLOR1	Marshalling Cabinet Field Termination 1; Color 1
MFT1 COLOR2	Marshalling Cabinet Field Termination 2; Color 2
MFT1 COLOR3	Marshalling Cabinet Field Termination 3; Color 3
MFT1 COLOR4	Marshalling Cabinet Field Termination 4; Color 4
MFT1 W1	Marshalling Cabinet Field Termination 1; Wire name
MFT1 W2	Marshalling Cabinet Field Termination 2; Wire name
MFT1 W3	Marshalling Cabinet Field Termination 3; Wire name
MFT1 W4	Marshalling Cabinet Field Termination 4; Wire name
MT1 01	Marshalling Cabinet Termination 1;(DCS SIDE)
MT1 02	Marshalling Cabinet Termination 2;(DCS SIDE)
MT1 03	Marshalling Cabinet Termination 3;(DCS SIDE)
MT1 04	Marshalling Cabinet Termination 4;(DCS SIDE)
PCI COMMENTS	PCI Comments and Concerns
PNAME	New Point Tagname
POWER	Field instrument power source FIELD,MARSH or DCS
RESETDESC	0 State or False State (DIGITAL POINTS)
RESISTOR	New Resistor Kind if Needed
SETDESC	1 State or True State (DIGITAL POINTS)
STAT_CHK_T	0 = Alarm if 0 State; 1 = Alarm if 1 State; N = No Status Check
TSCALE	Top Scale (AO's Only) in Engineering Units
UNIT_ID	Unit ID
XMIT_DESC	Transmitter Description (4-20 MA AI, 4-20 MA AO, DRY CONTACT, etc.)
XMIT_DESC_PCI	Transmitter description RAW
XMITTYP	Transmitter Type (MA, TJ (T/C, J-type, etc.), RP (RTD, Platinum, etc.)



4.9.6 Table P2 “Records Expected Back in I/O Partitioning Submittal”

FIELD NAME	DESCRIPTION	FROM
CARD_NAME	IO Module Name (assigned from IO Location)	DBID
CHARST	Characteristics provide a method for sorting the database based on plant area, signal, etc.	DBID
DROP_ID	Originating Drop ID number; 1-254	DBID
INDEX (PALIAS)	Unique Identifier (Also Emerson point alias)	DBID
IO_CHANNEL	I/O Card Point	DBID
IO_LOC	IO Location; P.N.B.LL, P – PCI, N – Node, B – Branch or Crate, L – Location or Slot (Node only for Remote)	DBID
NETWORK_ID	Network ID	DBID
TM1	Terminal 1; IO Wiring, Signal Name/Location	DBID
TM2	Terminal 2; IO Wiring, Signal Name/Location	DBID
TM3	Terminal 3; IO Wiring, Signal Name/Location	DBID
TM4	Terminal 4; IO Wiring, Signal Name/Location	DBID
TM5	Terminal 5; IO Wiring, Signal Name/Location	DBID
TM6	Terminal 6; IO Wiring, Signal Name/Location	DBID

4.9.7 Table P3: Records Expected Back in “ready for I/O Wiring Review” Submittal

FIELD NAME	DESCRIPTION	FROM
IO CABLE	IO Cable	CSM
IO CLOCATION	IO Cabinet Location (example 1CHS01F)	CSM
IO MODULE DWG	I/O Module Termination Drawing	CSM
IO SH	IO Card Termination for Shield Wire	CSM
IO_CARD_CAB	I/O Card Cabinet Number and Side (1CHS01F)	CSM
TM1 COLOR1	Terminal 1; Wire Color 1	CSM
TM2 COLOR2	Terminal 2; Wire Color 2	CSM
TM3 COLOR3	Terminal 3; Wire Color 3	CSM
TM4 COLOR4	Terminal 4; Wire Color 4	CSM
TM5 COLOR5	Terminal 5; Wire Color 5	CSM
TM6 COLOR6	Terminal 6; Wire Color 6	CSM

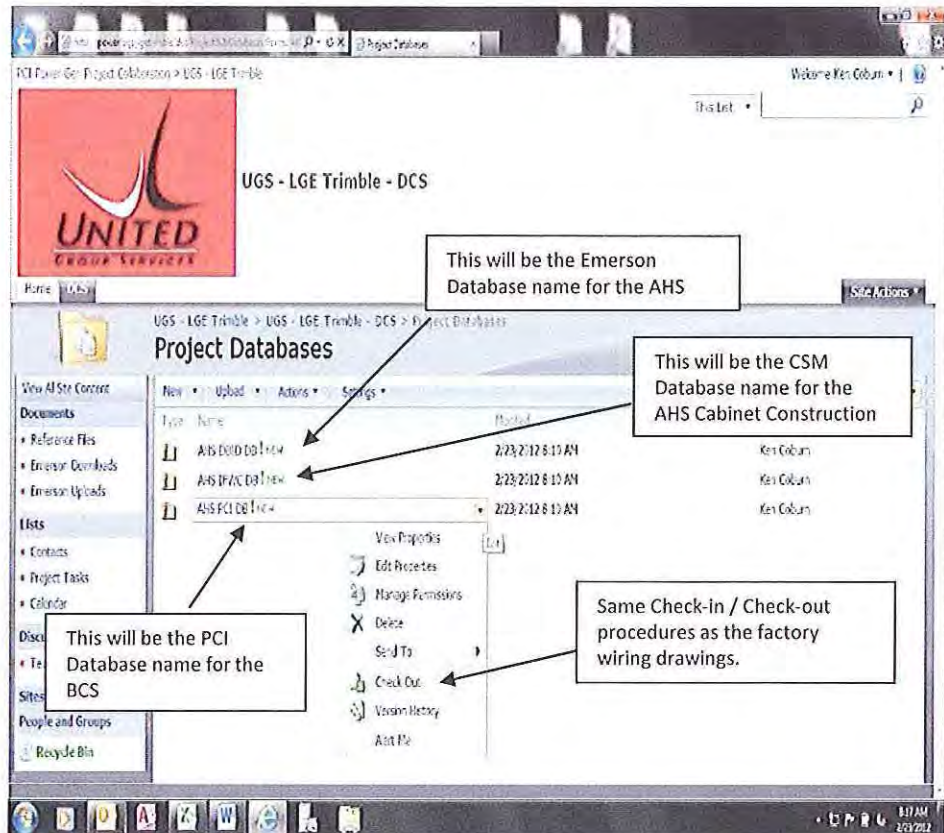
4.9.8 Table P4 “Point Change Form”

The following Form will be used to document the index number and a description of the change that occurred for any point in the system. This will assist in maintaining the DBID and the PCI database synchronized on a per point basis. This will need to be copied and placed in a formal e-mail and transmitted from PCI to EM or EM to PCI.

POINT CHANGE FORM		
SUBSYS: _____ UNIT: _____ DATE: _____		
INDEX #	Description of Change	Actions Taken
1053	New Point added by Plant	PCI to update IFWC database EM to update DBID database CSM to update prints and post on SharePoint
11075	Point made spare	PCI to update PCI database EM to update DBID database
4075	Engineering units changed	PCI to update PCI database EM to update DBID database

4.9.9 Example P1 “Databases on SharePoint”

This is an example of how we will be keeping track of the databases on SharePoint. This way the master is always known and the versions will be maintained.





4.10 Drawing Highlights/Markups

The following should be used as a key for drawing highlights/markups:

GREEN – Markups are designated as DEMO.

YELLOW – Markups are designated as KEEP. Yellow is also used to indicate that the portion of the drawing has been verified and is correct.

RED – Markups indicate a correction or an addition to the drawing.

ORANGE – Markups indicate highlighted portion of the drawing is in question.

BLUE/BLACK – Used for notes.



4.11 CHANGE/CLARIFICATION REQUEST

PROJECT

CHANGE ORDER

DATE

PROJECT

CLIENT AR

CLIENT PO

ATTN



PCI Skanska

CHANGE DESCRIPTION

IMPACT - ENGINEERING & PROCUREMENT

IMPACT - CONSTRUCTION

IMPACT - SCHEDULE

NOTES

We authorize the DCS Contractor to proceed with the work described above and accept the price and terms.

CHANGE TOTAL: \$

Company Authorization: _____

Jr
OSP



4.12 ENGINEERING CHANGE NOTICE

		ECN NO. _____		
ENGINEERING CHANGE NOTICE		CONTROL SYSTEM UPGRADE		DATE:
TO:		SHEET 1 OF		
PCI / LG&E DIST.	OTHER DIST.	REFERENCE DOCUMENT NO.	SHEETNO.	REV. NO.
SUBJECT:				
EFFECTS WORK IN PROGRESS: YES _____ NO _____		INFORMATION REQUESTED BY:		
REQUESTED BY:		COMPANY:		
RESPONSE				
TO:		APPROVED <	CLARIFIED REQ'D.	
COMPANY:		NOT APPROVED <	APPROVED EXCEPT AS NOTED	
DATE:				
RECEIVED BY:		DATE:		
COMPANY:		PCI ENGINEER:		
DATE:				

Appendix A “LG&E Drawing Requirements”

References: Also see Section 3.2.4 and Exhibit X, APPENDIX D – SPECIFICATIONS FOR ELECTRONIC SUBMITTAL OF ENGINEERED DRAWINGS

1.0 General

- 1.1 This specification provides minimum requirements on how CAD drawings shall be provided to the Owner.
- 1.2 Once the final copy is released to the Owner, the Owner will become the proprietor of the electronic drawing. The Owner will take full responsibility for all future modifications and their subsequent liability.
- 1.3 Unless otherwise specified in the contract or purchase order, only the final copy of the drawing shall be provided to the Owner in a CAD format. The final copy shall include all as-built or as-delivered modifications.
- 1.4 The Owner will provide to the Contractor a copy of all drawing title and revision blocks referred to in this specification.

2.0 Vector Based CAD Drawings

- 2.1 Drawings shall be provided in a .DWG format in Auto CAD 2004 version or later.
- 2.2 The Owner reserves the right to request a sample drawing to test our ability to access the drawing information.
- 2.3 The drawings shall be bordered by either of the following Owner's drawing sheets:

D size	0DLGESHT
E size	0ELGESHT (preferred)

See figures 1 and 2 for sizes. Additional title blocks (and sizes) are available by request.
- 2.4 The drawing sheet shall be inserted as a block retaining all of the title block attributes and layers.
- 2.5 The drawing sheet shall be inserted at the 0,0 coordinate such that the lower left hand corner of the sheet is at 0,0.
- 2.6 The title block attributes shall be filled out. See Table 1 for typical title block attributes and Figure 3 for a sample title block.
- 2.7 The Contractor shall provide their company name in the Originally Designed by attribute in the title block. In addition, they may insert their own title block or company logo to the immediate left of the Owner's title block. This information shall not stand taller than the Owner's title block. See Figure 3.
- 2.8 All non-dimensioned drawings shall be drawn at a 1 to 1 scale. These drawings include electrical schematics, wiring, and connection diagrams, mechanical flow diagrams, and logic diagrams.
- 2.9 No Contractor drawing information shall be placed on the layers used by the Owner's title blocks.



- 2.10 The Owner will provide a range of drawing numbers for the Contractor unless an alternate number scheme has been agreed upon.
- 2.11 The Contractor shall assign one drawing per owner's number. If a drawing has a "Sheet 1 of 2" and a "Sheet 2 of 2", each sheet shall have a separate drawing number and be saved in a separate drawing file. Whenever possible, the drawing numbers should be consecutive with the sheet numbers.
- 2.12 The Contractor may include their own drawing number in their title block (if included) but all internal and external drawing references shall utilize the Owner's assigned drawing number unless an alternate drawing number scheme has been agreed upon.
- 2.13 Drawing First preliminary drawings issued shall be labeled as Rev 1. Subsequent drawing issued shall use revision 2, 3, 4 until drawing is Issued for Construction (IFC). First IFC shall be issued with a blank in the Revision designation. Subsequent revisions shall start with the letter "A" and proceed through the alphabet skipping the letters "I" and "O".
- 2.14 All drawing revisions shall utilize the block 0REV218 provided. See figure 4.

3.0 Raster (or hybrid) Based CAD Drawings

- 3.1 Where required, hybrid CAD techniques may be employed to produce the final drawings.
- 3.2 Raster images shall be provided in a GP4 (CALs Group 4, Type 1).
- 3.3 A sample drawing (containing as a minimum both a DWG and a CAL/GP4 file) shall be provided to test our ability to access the hybrid drawing information.
- 3.4 All raster images shall be scanned at a 200 DPI resolution or greater.
- 3.5 Scanning shall be by the Contractor or by the Owner as outlined in the specific contract. The standard Owner's title block will be inserted onto the scanned image and the original raster title block shall be removed.
- 3.6 Prior to final submittal of Raster (or Hybrid) based CAD drawing they shall be vectorized. Contractor and Owner will agree upon drawings to be vectorized prior to final submittal.

ALL OTHER ITEMS IN SECTION 2 APPLY.

- 3.7 CAD Drawing Submittal
- 3.8 Final CAD drawings shall be submitted to Owner on CD.
- 3.9 Drawings may be created using cross references and/or links to other drawings but when the drawing is submitted to Owner all references shall be permanently bound into the final drawing.
- 3.10 Each drawing shall be submitted under a different file name. For example if three drawings are created using three different paper space views of the same model space, it shall be duplicated three times and only the view representative of the individual drawing shall be saved in the final file.
- 3.11 The final version of the drawing shall be saved with the standard ACAD menu.



- 3.12 If any non-standard AutoCAD fonts, etc. are used within the drawing, a copy shall be provided when the drawings are submitted to Owner.
- 3.13 The drawing files shall be named with the assigned drawing number and drawing revision. Long file names are acceptable.
- 3.14 The Contractor shall keep a backup copy of all electronic data provided to Owner for a minimum of 1 year from the date sent to Owner.
- 3.15 All drawings and media provided to Owner shall be fully manifested. This shall include an index in Excel or Access format which includes, as a minimum, the following information:

TABLE 1 – Typical Drawing Attribute Information

Field Name	Character Limit	Examples
Project	8	As agreed upon in the contract
Drawing Number	15	As agreed upon in the contract
Revision	1	Preliminary are 1,2,3, etc.; then issued the first time no revision, first rev and forward are A, B, C, etc.
Original creation date	8	12/01/00
Latest revision date	8	12/31/00
Title	96	
Location	3	MC4 or TC 1 or GH0 (0=common systems)
Engineering Discipline	1	E=electrical, C=civil, M=mechanical, A=architectural
Drawing Type	Any	wiring, schematic, flow, logic, site plan, foundation, piping, details, steel, etc.
Drawing size	1	D or E, etc.
Scale	Any	¼"=1', none, as noted, etc.
CAD Filename	Any	Must meet Win95 long filename criteria
Release Reason	Any	Construction, Approval, Reference, etc.

Figure 1
0DLGESHT.DWG 36" x 24" ("D" size)

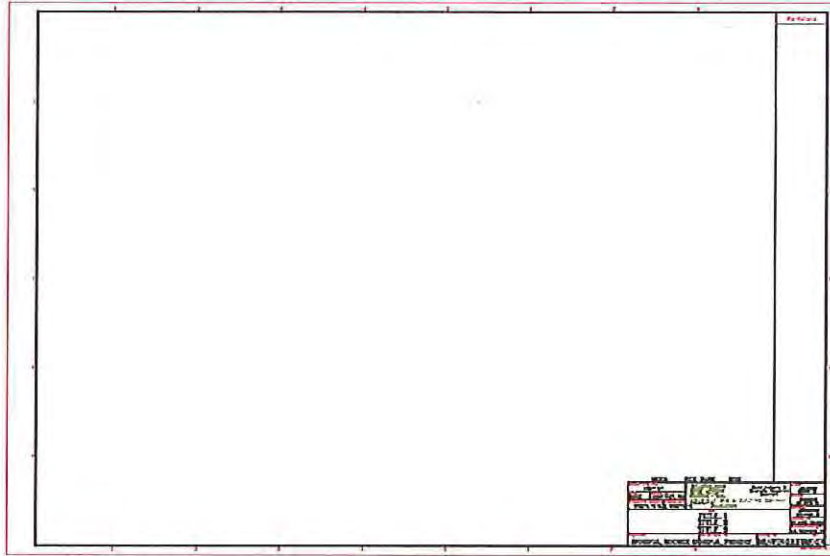


Figure 2
0ELGESHT.DWG 48" x 34" ("E" size)

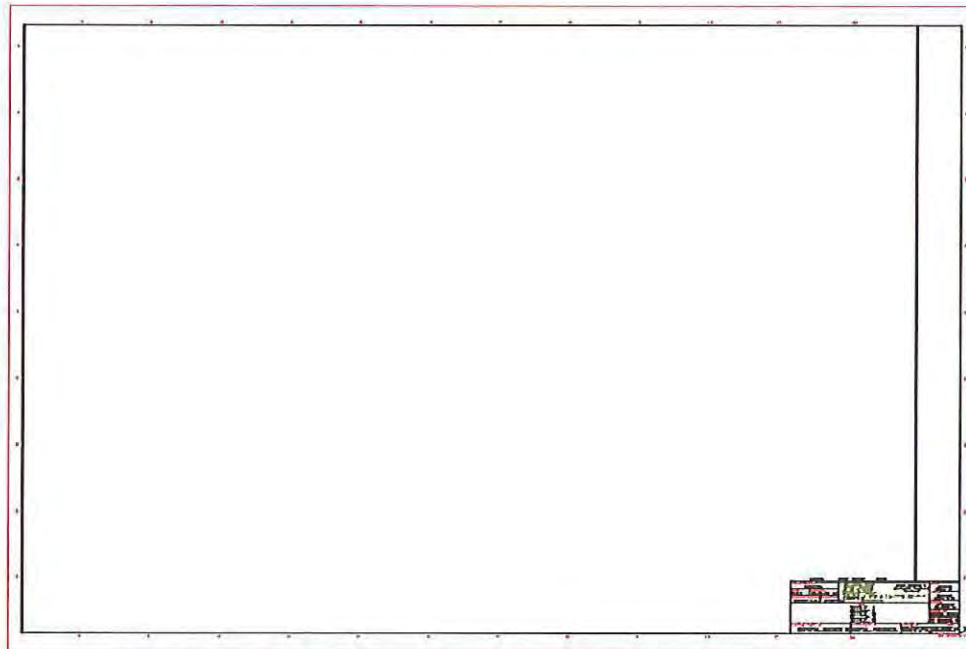


EXHIBIT AA

EXTENDED WARRANTIES

1.1 Standing-Seam Roof Panel Weather Tightness Warranty

Reference: Exhibit A 133419 – Metal Building Systems.

Contractor will provide to the extent available on commercially reasonable terms written warranty, executed by manufacturer, that all metal standing-seam roof panels under this project will remain weather tight for a period of ten (10) years from date of Commercial Operation.

1.2 Pipe Freeze Protection Systems Warranty

Reference: Exhibit A 260507-1.01H – Pipe Freeze Protection System.

Contractor will provide to the extent available on commercially reasonable terms written factory warranty, executed by manufacturer, that all components of the pipe freeze protection systems under this project shall not fail in materials and workmanship for a period of ten (10) years from the date of Commercial Operation.

1.3 480-Volt Variable Frequency Drives Warranty

Reference: Exhibit A 262421-2.10B – 480-Volt Variable Frequency Drives.

Contractor will provide to the extent available on commercially reasonable terms written warranty, executed by manufacturer, that all parts for the 480-volt variable frequency drives under this project will be available for a minimum of ten (10) years from the date of Commercial Operation.

1.4 Fluorescent Light Fixture Electronic Ballasts Warranty

Reference: Exhibit A 265000-2.03C.1.i. – Lighting, Receptacles, and Controlling Devices.

Contractor will provide to the extent available on commercially reasonable terms a written warranty, executed by manufacturer, for all fluorescent light fixture electronic ballasts under this project. The warranty period shall be for a period of three (3) years from the date of Commercial Operation and shall cover all parts and labor.

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