ENGINEERED PUMP SERVICES, INC.
624 Perkins Drive ! Mukwonago, WI 53149-1454
(262)363-9002 ! (800)657-0845 ! fax (262)363-9013
www.epspumps.com ! email: eps@epspumps.com

INSPECTION REPORT

CUSTOMER	: East Kentucky Power Cooperative	REPORT DATE	: 12/17/21
PLANT NAME	: Spurlock Generating Station	REPORT NO.	: 56743-IR1
CITY/STATE	: Maysville, Kentucky	CUST. ORDER	: TBD
EQUIPMENT	: 29" APKD - 4	COPY	: Anthony Ring
SERVICE	: Condensate Water		
MANF.	: Ingersoll-Rand	FILE	: 56743
SERIAL NO.	: Unit #2	PAGE	: 1 of 4 Pages

The subject pump element was sent to EPS as part of a planned overhaul in fall 2021. The scope of this overhaul was to use an existing (repaired) pump element and match it to the upper components of a complete pump assembly needing overhaul. The lower element removed from that complete pump is the subject of this inspection report. The pump element was completely dismantled and glass bead blasted clean with the exception of the shafts which were only hand cleaned. The pump element was then visually and dimensionally inspected; furthermore, the impellers and shafting were submitted for non destructive testing. The results of the inspection are discussed in detail below and are listed by part name. Please see the attached inspection data sheets for the as-found dimensions, fits, and clearances.

Overall Condition – The pump has the typical light to moderate wear seen on condensate pumps that have been in service for a long period of time. Typically speaking, the impeller to case ring clearances and bearing to shaft journal sleeve clearances are all moderately excessive. As mentioned in the paragraphs below, the shaft to impeller clearances and most of the casing fits are marginally loose which might account for some of the higher running clearances measured. The impellers are in overall good condition, and there was no significant amount of cavitation damage.

Pump Shaft – All of the impeller and bearing journal sleeve fits measure consistently to a uniform diameter; however, the impeller to shaft fit clearances are all marginally excessive. The total indicated runout (TIR) of the shaft is .005" which is marginal for a condensate pump application. The coupling sleeve was very difficult to remove and had to be cut at disassembly. The underlying shaft turn was moderately galled as a result. Utlrasonic and magnetic particle testing did not reveal any linear indications of damage.

BY: Aaron Stull
Aaron Stull

INSPECTION REPORT

Upper Shaft – The upper shaft body measures consistently to a uniform diameter across all coupling and journal sleeve fits. The total indicated runout (TIR) of the shaft is .005" which is marginal for this application. There is a small area of deep wear at the top of the shaft caused by contact with the floating seal ring of the mechanical seal assembly. Utlrasonic and magnetic particle testing did not reveal any linear indications of damage.

Impeller Split Retaining Rings – Overall, the retaining rings are in good condition with minor tool damage at the parting line and light working damage on the axial mounting faces. Dimensionally, all the rings measure to a uniform thickness with appropriate axial clearance to the shaft grooves.

Impellers – Generally speaking, the impellers are in fair dimensional and good visual condition. As mentioned above, the fit clearances to the shaft are all marginally excessive. All of the impeller sealing turns are integral to the impeller (no wear rings) and only have very light visible grooving and wear; the resulting running clearances to the case ring are all moderately excessive. As mentioned previously, the 1st stage impeller has only minor cavitation on the vanes and vane fillets. All impellers had multiple linear indications when magnetic particle NDE tested.

Journal Sleeves – The (8) shaft sleeves are in fair condition with light to moderate eccentric radial wear on the outer diameters; as mentioned previously, the resulting running clearances to the graphite bearings are all moderately excessive. The fit bores to the shaft all measure to expected design diameters with appropriate fit clearances to the shaft.

Impeller Keys – With a couple of exceptions, all of the impeller keys are in good visual condition. Typically speaking, the key widths are moderately undersized resulting in a loose fit to the shaft.

Suction Bell – Overall, the suction bell is in fair condition. The wear ring and tail bearing show light visible wear, and the resulting running clearances are moderately oversized. There is minor cavitation damage on the inlet suction faces and some unusual cavitation in the lower bearing. The male fit turn to the 1st casing section measures over the existing diameter with the resulting fit actually measuring as interference instead of light clearance. There does not to be any galling or lack of sealing resulting from this tight fit.

First Stage Casing – The first stage casing is in overall good visual condition. The fit clearances to the mating series casing and suction bell are marginally excessive. The bearing bore has moderate wear resulting in excessive fit clearance to the journal sleeve. The suction inlet guide for to the 1st stage impeller has minor cavitation damage. Both case wear rings are lightly worn with excessive running clearances to the impellers.

INSPECTION REPORT

Series Casing – The (2) series stage casings are in fair visual condition. Both stages have little or no vane damage and negligible corrosion. The fit clearances between all stages are marginally out of tolerance. Both bearing bores have moderate wear resulting in excessive fit clearance to the journal sleeves. Both case rings are lightly worn with excessive running clearances to the impellers.

Upper Casing – The upper casing is in good visual condition with little or no vane damage and negligible corrosion. The fit turn to the lower column measures to the expected design diameter. The bearing bore has moderate wear resulting in excessive fit clearance to the journal sleeve.

Hardware – Generally speaking, the hardware is in fair condition although some studs have worn or rolled threads.

Photo 1: Pump As Received

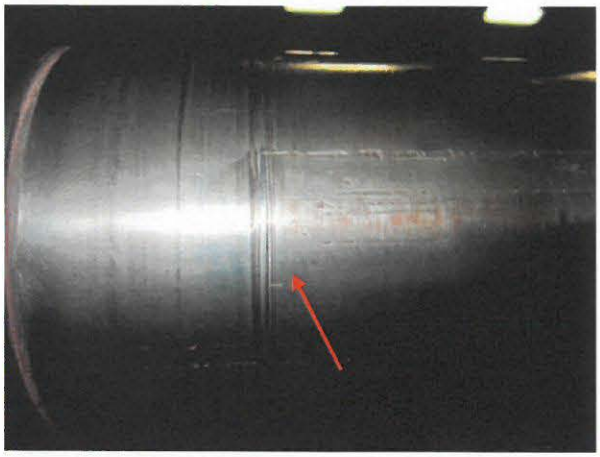


Photo 2: Seal Ring Wear On Upper Shaft

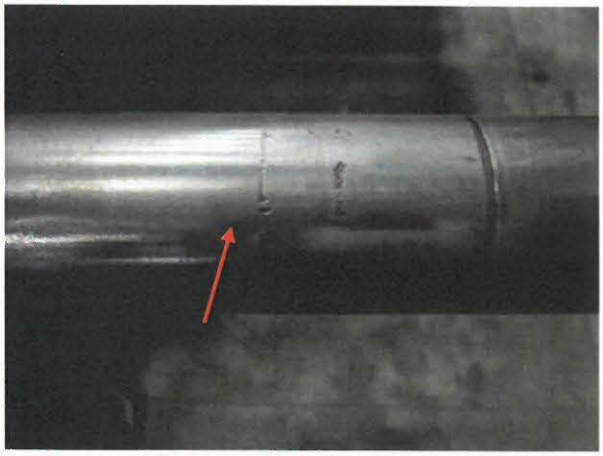


Photo 3: Shaft Galls At 1st Stage Impeller Nut

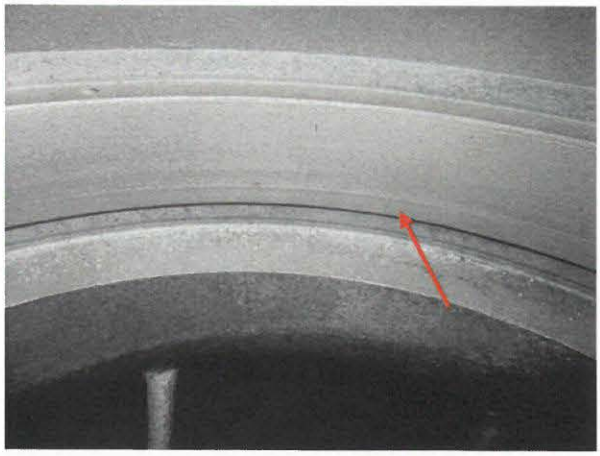


Photo 4: Typical Case Ring Wear

INSPECTION REPORT

CUSTOMER : EKPC-Spurlock **REPORT DATE : 12/17/21**
REPORT NO. : 56743-IR1 **PAGE NO. : 4 of 4**

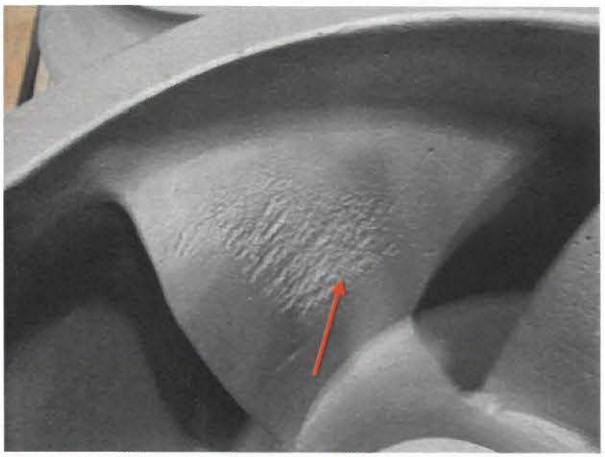


Photo 5: Typical Cavitiation On 1st Stage Impeller

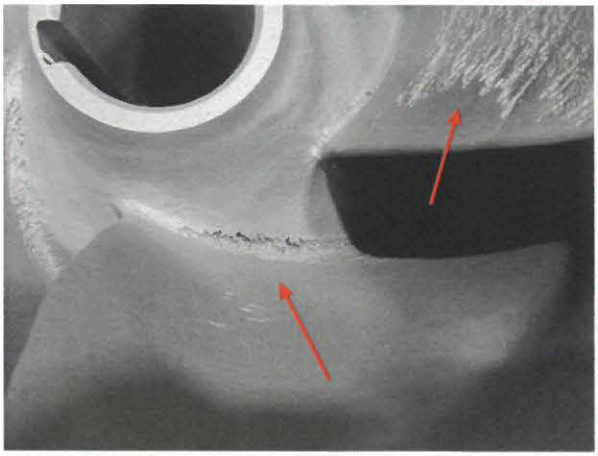


Photo 6: Typical Cavitiation On 1st Stage Impeller

Photo 7: Typical Wear On Series Bearing

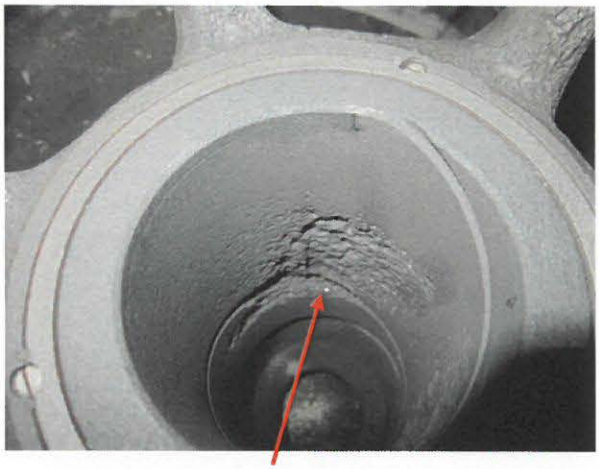
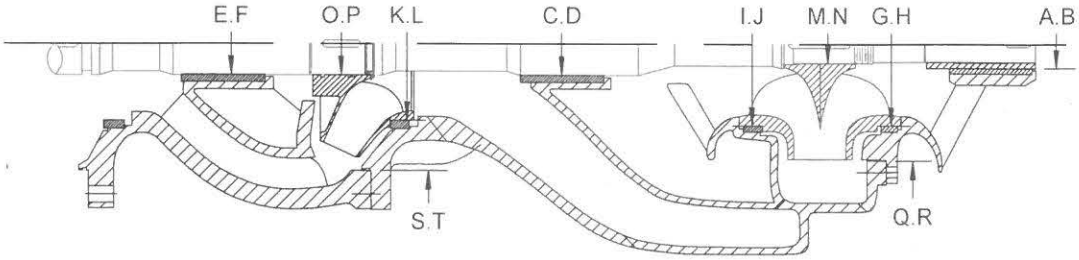


Photo 8: Cavitation Damage On Suction Bearing

Photo 9: Typical Wear On Series Shaft Sleeves

Photo 10: Wear On Suction Shaft Sleeve

EPS JOB #	56743	CUSTOMER	EAST KENTUCKY POWER
PO #		PLANT	SPURLOCK
INSP. BY	ACS	SERIAL #	UNIT #2
DATE	12/17/21		



RUNNING CLR.		STAGE 1		STAGE 2		STAGE 3		STAGE 4	
A	BEARING BORE	2.507	2.511						
B	SLEEVE TURN	2.490	2.500						
CLR.		**0.007**	**0.021**						
C	BEARING BORE	4.780	4.790						
D	SLEEVE TURN	4.742	4.750						
CLR.		**0.030**	**0.048**						
E	BEARING BORE			4.770	4.773	4.773	4.780	4.768	4.775
F	SLEEVE TURN			4.742	4.750	4.742	4.750	4.742	4.750
CLR.				**0.020**	**0.031**	**0.023**	**0.038**	**0.018**	**0.033**
G	RING BORE	10.504	10.506						
H	IMPELLER TURN	10.481	10.483						
CLR.		**0.021**	**0.025**						
I	RING BORE	10.503	10.506						
J	IMPELLER TURN	10.482	10.483						
CLR.		**0.020**	**0.024**						
K	RING BORE			10.503	10.507	10.505	10.507	10.504	10.505
L	IMPELLER TURN			10.482	10.485	10.483	10.485	10.482	10.483
CLR.				**0.018**	**0.025**	**0.020**	**0.024**	**0.021**	**0.023**
FITS									
M	IMPELLER BORE	2.125	2.127						
N	SHAFT TURN	2.123	2.124						
FIT		**0.001**	**0.004**						
O	IMPELLER BORE			4.253	4.254	4.253	4.254	4.253	4.255
P	SHAFT TURN			4.249	4.249	4.249	4.249	4.249	4.250
FIT				**0.004**	**0.005**	**0.004**	**0.005**	**0.003**	**0.006**
Q	CASING BORE	15.002	15.003						
R	SUC. BELL TURN	15.003	15.004						
FIT		**-0.002**	**0.000**						
S	CASING BORE			17.002	17.003	17.003	17.004	17.003	17.004
T	CASING TURN			16.998	16.999	16.999	16.999	16.998	16.999
FIT				**0.003**	**0.005**	**0.004**	**0.005**	**0.004**	**0.006**

SMG 06/03/2011

1

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES
TOLERANCES:
DECIMALS: .X ± .1, .XX ± .01, .XXX ± .005
ANGULAR: ± .25°
SURFACE ROUGHNESS N/A

3RD ANGLE PROJECTION

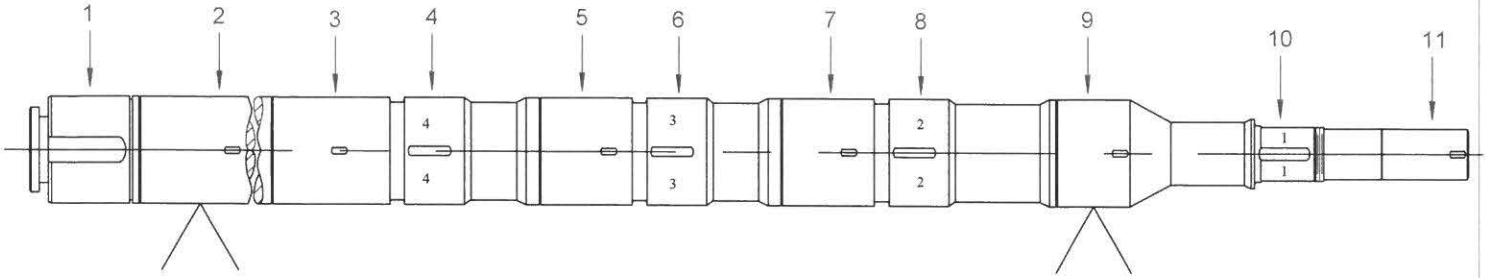
DRAWN BY SMG
CHECKED BY

ENGINEERED PUMP SERVICES, INC.
MUKWONAGO, WISCONSIN

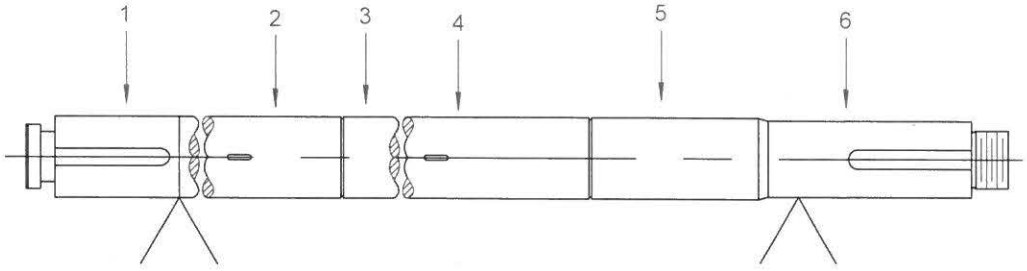
SIZE A | PART NAME APKD INSPECTION
PART NO. 103-500-149
MATERIAL ASSY
SCALE NTS | WEIGHT LBS. | SHEET 1 OF 2 | REV 1

REMOVE ALL BURRS AND SHARP EDGES .03 MAX RADIUS OR CHAMFER.

EPS JOB #	56743	CUSTOMER	EAST KENTUCKY POWER
PO #		PLANT	SPURLOCK
INSP. BY	ACS	SERIAL #	UNIT #2
DATE	12/17/21		



	1	2	3	4	5	6	7	8	9	10	11
0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
90	-.0020	-.0020	-.0010	-.0010	-.0010	-.0005	-.0005	.0000	+.0020	+.0010	+.0010
180	-.0020	-.0030	-.0010	-.0010	-.0010	-.0005	.0000	+.0010	+.0020	-.0020	-.0020
270	-.0005	-.0010	.0000	-.0010	.0000	-.0005	.0000	+.0010	+.0015	-.0020	-.0030



	1	2	3	4	5	6
0	.0000	.0000	.0000	.0000	.0000	.0000
90	.0000	-.0010	-.0010	-.0030	-.0010	+.0020
180	.0000	.0000	+.0005	-.0020	-.0010	+.0020
270	-.0010	+.0010	+.0010	.0000	.0000	.0000

SMG 06/03/2011

1

UNLESS OTHERWISE SPECIFIED

ALL DIMENSIONS ARE IN INCHES

TOLERANCES:

DECIMALS		ANGULAR
.X	± .1	± .25°
.XX	± .01	
.XXX	± .005	

SURFACE ROUGHNESS N/A

3RD ANGLE PROJECTION

DRAWN BY SMG

CHECKED BY

ENGINEERED PUMP SERVICES, INC.

MUKWONAGO, WISCONSIN

SIZE	PART NAME
A	APKD INSPECTION

PART NO. 103-500-149

MATERIAL ASSY

SCALE	WEIGHT	SHEET	REV
NTS	LBS.	2 OF 2	1

REMOVE ALL BURRS AND SHARP EDGES .03 MAX RADIUS OR CHAMFER.

ACUREN

This test is accredited and meet(s) the requirements of ISO/IEC 17025 as verified by the ANSI-ASQ National Accreditation Board/ANAB. Refer to certificate and scope of accreditation (L-2243 Milwaukee).

Acuren Inspection, Inc.
3710 North Richards Street
Milwaukee, Wisconsin 53212

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Report Number: MIL3272

MAGNETIC PARTICLE EXAMINATION REPORT

CUSTOMER:	ACUREN SERVICE CALL #:	DATE:
ENGINEERED PUMP SERVICES	765601	12/16/2021

LOCATION/ADDRESS:	CUSTOMER CONTACT:
3710 North Richards Street Milwaukee, Wisconsin 53212	RICHARD LAUX

PART # / DRAWING #:	CUSTOMER PO #:	CUSTOMER WO #:
Impeller	3034255	See below.

ITEM DESCRIPTION:	STAGE OF MANUFACTURE:	SURFACE CONDITION:
N/A	In Process	Media Blasted

SURFACE PREPARATION:	COMMENT:	PARTS INSPECTED:	ACCEPTABLE:	REJECTED:
N/A	N/A	4	1	3

NDE PROCEDURE	REV.	SPECIFICATION/CODE	REV./EDITION	ACCEPTANCE STANDARD
MT-5	2	ASTM E 709-15	2015	CLIENT SPEC / NO LINEARS

MATERIAL:	THICKNESS:	QUANTITY:	ITEM TEMP.:
N/A	varied in.	4	70 °F

☐ Wet	☐ Dry	☑ Continuous	☐ AC	☐ Halfwave	Weight S/N's	
☑ Fluorescent	☐ Perm. Magnet	☐ Residual	☑ DC	☑ Fullwave	1. N/A	
☐ Yoke	☐ Spacing:	☐ Prod. Spacing:	Amps: 50%		2. N/A	
☑ Circular	☑ Direct Contact	☐ Central Conductor	Amps:	Yoke Daily Verification:	3. N/A	
☑ Longitudinal	☐ Wrap, Turns:	☐ Fixed Coil Turns	Amps:	☐ Acc. ☐ Rej. ☐ N/A	4. N/A	

EQUIPMENT MODEL:	SERIAL NO.:	CAL. DUE DATE:	MEDIUM MANUFACTURER:	TYPE:	COLOR:	BATCH NO.:
Magnaflux MD3-2060-LR	202289	01/09/2022	Magnaflux	14A	BLK	19G047

DEMAGNETIZATION EQUIPMENT: AC Coil — ☑ Yes ☐ No

BLACKLIGHT MFG, OR LIST APPROVED LIGHT SOURCE:	SERIAL NO.:	LIGHTMETER MFG./SN:	SERIAL NO.:	CAL. DUE DATE:	INTENSITY: 3500
Rel, Inc.	02231704	121020A	208914	08/03/2022	☐ FC ☐ LUX ☑ µW/CM²

Items	Quantity	Comments	Accept/Reject
	1	Accepted. Serial # 4	Accept
	3	Serial # 1, 2, 3 rejected. See weld maps.	Reject
	INFO	Customer: EKPC-Spurlock Pump: Ingersoll-Rand 29" APKD-4	Info. Only
	INFO	Job Number: 56743-01 Order Number: 3034255	Info. Only

☐ High Temp	Wire Wheel:	Other:	Customer Contact:

Per Diem:	Unit #:	No. on Job:	Travel if Applicable: Hours: Miles Total:	Hours Worked: to and to	Total Hours:

CLIENT REPRESENTATIVE — Print Name / Signature — Date

ACUREN INSPECTOR: Kyle Schmidt — Print Name / Signature — 12/16/2021 — Date — NAS 410 II — Inspection Level

PEER REVIEW (IF APPLICABLE): Print Name / Signature — Date

Acuren Inspection, Inc.
3710 North Richards Street
Milwaukee, Wisconsin 53212

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Report Number: MIL3272

PHOTOGRAPHIC SUMMARY SHEET

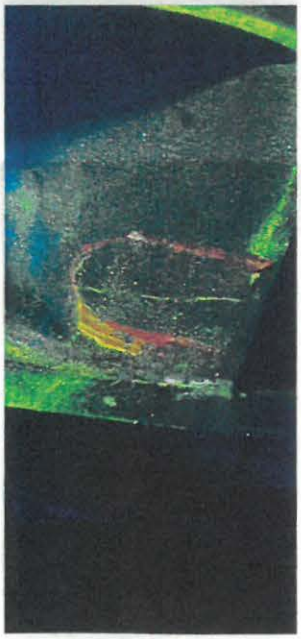
CUSTOMER:	ACUREN SERVICE CALL #:	DATE:
ENGINEERED PUMP SERVICES	765601	12/16/2021
LOCATION/ADDRESS:	**CUSTOMER CONTACT:**	
3710 North Richards Street Milwaukee, Wisconsin 53212	RICHARD LAUX	
PART # / DRAWING #:	**CUSTOMER PO #:**	**CUSTOMER WO #:**
Impeller	3034255	See below.
ITEM DESCRIPTION:	**STAGE OF MANUFACTURE:**	**SURFACE CONDITION:**
N/A	In Process	Media Blasted

Photo 1

Serial # 1 rejected for 1/4" crack. (Picture Zoomed)

Photo 2

Serial # 2 rejected for 1" through-wall crack.



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Report Number: MIL3272

PHOTOGRAPHIC SUMMARY SHEET

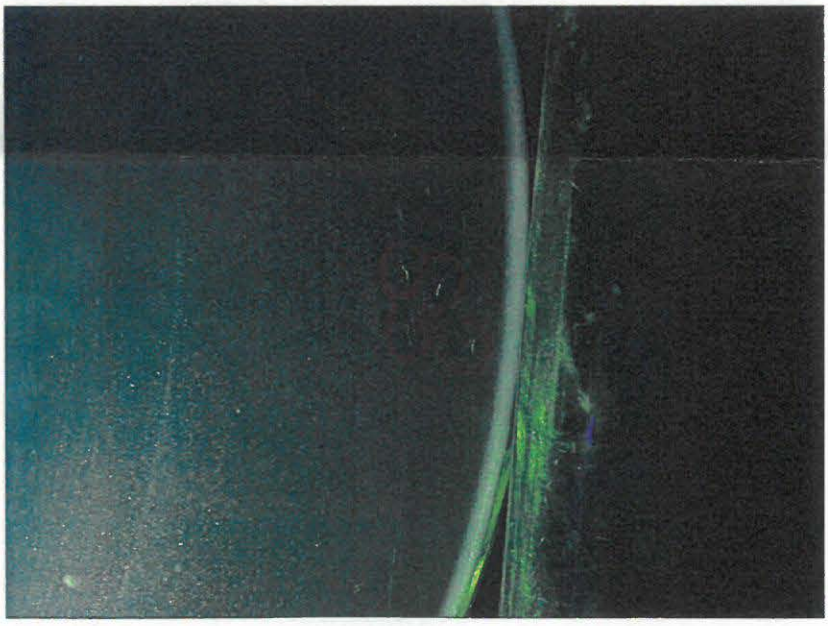
CUSTOMER:	ACUREN SERVICE CALL #:	DATE:
ENGINEERED PUMP SERVICES	765601	12/16/2021
LOCATION/ADDRESS:	CUSTOMER CONTACT:	
3710 North Richards Street Milwaukee, Wisconsin 53212	RICHARD LAUX	
PART # / DRAWING #:	CUSTOMER PO #:	CUSTOMER WO #:
Impeller	3034255	See below.
ITEM DESCRIPTION:	STAGE OF MANUFACTURE:	SURFACE CONDITION:
N/A	In Process	Media Blasted

Photo 3

Serial # 3 rejected for multiple 1/16"-1/8" cracks.

Photo 4

Serial # 3 rejected for multiple 1/16"-1/8" cracks.



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Report Number: MIL3272

PHOTOGRAPHIC SUMMARY SHEET

CUSTOMER:	ACUREN SERVICE CALL #:	DATE:
ENGINEERED PUMP SERVICES	765601	12/16/2021
LOCATION/ADDRESS:	CUSTOMER CONTACT:	
3710 North Richards Street Milwaukee, Wisconsin 53212	RICHARD LAUX	
PART # / DRAWING #:	CUSTOMER PO #:	CUSTOMER WO #:
Impeller	3034255	See below.
ITEM DESCRIPTION:	STAGE OF MANUFACTURE:	SURFACE CONDITION:
N/A	In Process	Media Blasted

Photo 5

Serial # 3 rejected for multiple 1/16"-1/8" cracks.

Photo 6

Serial # 3 rejected for multiple 1/16"-1/8" cracks.