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FLUOR.

Sipchem

LIQUID RING VACUUM PUMP AND COMPRESSOR SYSTEM DATA SHEET

Contract:	A2WT
Item No.:	15-C-1102
Unit:	15
P.O. No.:	15-ME-PO-43C02-03
Inquiry No.:	

Engineer	Rev	By	Date	
Process	1		11/16/07	1
Mechanical:	1		9/27/07	1

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Document number 15-C-1102-MDS-001

DESIGN, MANUFACTURE, INSPECTION, AND TESTING SHALL CONFORM TO SPECIFICATION:

INFORMATION TO BE COMPLETED : ○ BY PURCHASER ☐ BY MANUFACTURER ☐ BY PURCHASER OR MANUFACTURER

Applicable to: ○ Proposal ● Purchase ○ As Built | Service: Vent Gas Compressor

For: SIPCHEM | Unit: 15 | Site: Jubail

No. Systems Required: One | Size: | No. Stages: One | Model: NSB SB 2.25-120H | 1

Manufacturer: NSB | Vendc SIHI Pumps Ltd. | Serial No.

VACUUM PUMP OR COMPRESSOR DATA - GENERAL

No. Required: 1+Spare	Motor Item No.:	Turbine Item No.: 15-TC-1102	1
Item No. 15-C-1102	Motor Provided by:	Turbine Provided by: Dresser Rand	1
No. Motor Driven:	Motor Mounted by:	Turbine Mounted by: SIHI	
No. Turbine Driven: 1	Driver Data Sheet Nos.:	Turbine Data Sheet Nos.:	

SYSTEM DESCRIPTION

○ Liquid Ring Vacuum Pump ● Liquid Ring Compressor

LIQUID RING SYSTEM (Appendix D)

○ Once Through System
○ Partial Recirculation System
● Total Recirculation System

Service: ● Continuous ○ Intermittent ○ Starts/Day:

○ Inlet System Volume: (m³)

○ Required Evacuation Time: (min.)

SITE AND UTILITY DATA

Location:

○ Indoor ○ Heated ● Under Roof
● Outdoor ● Unheated ○ Partial Sides
○ Grade ○ Mezzanine ○

● Electric Area Classification:

Class: 1 Zone: 2 Group: IIA, IIB, IIC, T3

○ Winterization Required. ○ Tropicalization Reqd.

Steam Conditions	Drivers Press (Barg)	Drivers Temp (°C)	Heating Press(Barg)	Heating Temp (°C)
Min.	42	400		
Max.	46.7	405		

Electricity	Drivers	Heating	Control	Shutdown
Voltage	460		24VDC	
Phase	3			
Hertz	60			

Elevation: (m); Barometer: (mBara)

Ambient Temp. Range: Max: 50 Min: 0 (°C)

Relative Humidity (%) Max: 100 Min: 10

Unusual Conditions: ● Dust ○ Fumes

● Corrosive Due to: Acetic acid

Cooling Water Temp.- Inlet: Norm: 15 (°C)

Min: Max: Max. Return: 35 (°C)

○ Pressure- Normal: 4.4 Design 12 (Barg)

Min. Return: 1.4 Max. Allow. DP: (Barg)

○ Water Source:

Instrument Air Press: - Max:8.0 Min: 6.5 (Barg)

RING LIQUID

● Type / Name of liquid: Acetic Acid

○ Supply Temperature-

Normal: 40 Max: Min: (°C)

● Supply Pressure: 9.24 (Barg)

○ Vapor Pressure (Barg)

○ Specific Gravity @ Max. Temperature:

○ Specific Heat: (kcal/kg.°C)

○ Viscosity: cP @ (°C)

○ Max. Viscosity @ Min. Temperature: (cP)

○ Corrosive / Erosive Agent:

○ Chloride Concentration: (ppm)

○ H_2S Concentration: (ppm)

● Toxic ● Flammable ○ Other (3.5.2.11)

○ Ring Liquid Purge System (3.1.8)

☐ Circulation Rate: (m^3/hr)

☐ Make-up Rate: (m^3/hr)

☐ System Volume: (m^3)

☐ System Design Pressure:

☐ Gas Solubility in Ring Liq: kg/kg@ mmWG & °C

NOISE SPECIFICATION

● Applicable to Machine: < 85 dBA@1m

○ Applicable to Neighborhood:

Acoustic Housing: ○ Yes ○ No

APPLICABLE SPECIFICATIONS

API 681, Liquid Ring Vacuum Pump and Compressor Systems for Refinery Service.

○ Governing Specifications (if different)

PAINTING (4.4.2)

○ Manufacturer's Standard

○ Unified, System Supplier's Standard: 1

● Other: JAC-IP-00-SS-004

SHIPMENT (4.4)

○ Domestic ○ Export ● Export Boxing Reqd. 1

● Outdoor Storage More Than Six Months (4.4.1)

Reason for revision: Spare liquid ring compressor has been added. 1

ISSUED FOR PURCHASE

FLUOR.

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Inquiry No.:	

Engineer	Rev	By	Date
Process	1	RS	1/10/07
Mechanical:	1	KP	9/27/07

OPERATING CONDITIONS

(All data on Per Unit Basis)	NORMAL	RATED	START-UP	OTHER CONDITIONS MIN	OTHER CONDITIONS ALT	
○ Gas Handled						
○ m³/hr (1.013 bar & 0°C dry)	2247	2472		1573	2146	
○ Mass Flow (kg/h) (wet)	3687	4056		2581	3373	
INLET CONDITIONS -						
○ Pressure (Bara)	1.172	1.172		1.172	1.172	
○ Temperature (°C)	40.6	40.6		40.6	40.6	
○ Relative Humidity (%)						
○ Molecular Weight	37.4	37.4		37.4	37.4	
☐ C_p/C_v (K_1) or (K_{avg})	1.206	1.206		1.206	1.206	
☐ Compressibility (Z_1) or (Z_{avg})	0.9694	0.9694		0.9693	0.9694	
☐ Inlet Volume Flow (m³/hr) (wet/dry)	2127	2340		1489	2031	
DISCHARGE CONDITIONS -						
○ Pressure (Bara) 105	7.2	7.2		7.2	7.2	
○ Temperature (°C)						
■ C_p/C_v (K_2) or (K_{avg})	1.257	1.257		1.257	1.257	1
■ Compressibility (Z_2) or (Z_{avg})	0.9535	0.9535		0.9535	0.9535	1
■ BkW required (All losses included)	590	685		420	555	1
☐ BkW required at RV setting (.... barg)						
■ Speed (RPM)	1030	1131		850	990	1
● Guarantee Point	X					
■ Performance Curve No.	X					

Gas Characteristics: ● Toxic ● Flammable ○ Other:

Gas Analysis: ○ mol % ○	MW	NORMAL	RATED	START-UP	OTHER CONDITIONS MIN	OTHER CONDITIONS ALT	Remarks (2.9.1.13)
Acetic acid	60.050	5.408	5.408		5.408	5.426	
Water	18.016	1.233	1.233		1.233	1.222	
Vinyl Acetate	86.090	0.583	0.583		0.583	0.496	
Acetaldehyde	44.060	1.875	1.875		1.875	1.921	
Ethylene	28.052	45.314	45.314		45.314	53.68	
Carbon Dioxide	44.010	44.095	44.095		44.095	34.16	
Nitrogen	28.016	0.101	0.101		0.101	0.225	
Oxygen	32.00	0.342	0.342		0.342	0.329	(2.9.1.6) (2.9.1.9)
Argon	39950	0.373	0.373		0.373	0.881	
Methane	16.042	0.092	0.092		0.092	0.244	
Ethane	30.068	0.575	0.575		0.575	1.420	
Total							
Avg. Mol. Wt.							

Note 1: If gas analysis is given, manufacturer shall supply data; otherwise data shall be supplied by user.

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Mechanical:	1	AP	9/27/07	1

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LIQUID RING MACHINE CONSTRUCTION FEATURES

SPEEDS

- ■ Rotation, Viewed from Driven End ■ CW ☐ CCW
- ■ Max. Continuous: 1200 ☐ Trip rpm
- ☐ Minimum Stable Speed: rpm
- ☐ Lateral Critical Speeds - rpm
  First: rpm: mode
- ● Typical Lateral Analysis Required (2.7.1.7)
- ○ Undamped Stiffness Map Required
- ● Train Torsional Analysis Required (2.7.1.7)
- ☐ First Torsional Critical Speed: rpm
- ☐ Vibration- Allowable Test Level (μm) (mm/sec)

MATERIAL INSPECTION REQUIREMENTS (4.2.2) Note 1

- ○ Charpy Testing (2.9.4)
- ● Radiography Required for: Note 1
- ○ Magnetic Particle Required for:
- ● Liquid Penetrant Required for: Impeller, Note 2

CASING

- ☐ Model: ☐ Casing Split:
- ■ Material (2.9.2.5) Stainless steel DIN 1.4404 or ASTM 316L
- ☐ Thickness: (mm); Corr.Allowance.: (mm)
- ☐ Manifold Material:
- ■ Port Plate / Cone Material: Stainless steel DIN 1.4404
- ■ Max. Working Pressure 14 barg
- ■ Max. Design Pressure: 16 barg
- ■ Test Press. (barg) - Helium: Hydro: 24
- ■ Oper. Temp. (°C)- Max: 150 Min: -10
- ☐ Max. Casing Capacity: am³/hr
- ○ Casing Studs Required (2.2.6.2)
- ● Casing Disassembly Jackscrews (2.2.7)
- ○ Spot Faced Mounting Holes (2.2.8)
- ○ Casing Vertical Jackscrews and Dowel Pilot Holes (2.2.9)
- ☐ Radiography Quality
- ○ System Relief Valve Set Pr. (2.2.2): barg

ROTORS

- ■ No.: 2 ■ Solid ☐ Hollow
- ■ Diameters (mm): Ø570/690
- ■ No. Vanes Per Rotor: 22
- Type: ☐ Open ■ Closed ☐ Other:
- ☐ Type Fabrication:
- ☐ Material: Stainless steel DIN 1.4404 or ASTM 316L
- ☐ Max. Yield Strength: kg/mm²
- ☐ Brinnel Hardness- Max: Min:
- ■ Dynamically balanced: Quality 2.5

SHAFT

- ☐ Material:
- ■ Dia.- @ Rotor: 100 @ Coupling: 110 (mm)
- Shaft End: ☐ Tapered ■ Cylindrical

SHAFT SLEEVES (2.5.5)

- ■ At Shaft Seals - Material: Stainless steel AST 316L

BEARING HOUSINGS

- ☐ Cast Iron ☐ Ductile Iron ■ Steel
- Seals: ○ Lip Type ● Labyrinth (2.8.2.5)
- ○ Vibration Probe Provisions (2.8.2.6)

BEARINGS AND LUBRICATION

Bearings -	Type	No.	Clearance	
■ Radial	7232	2	Standard	
■ Thrust	6324	1	Standard	1

Lubrication:

- ■ Grease ☐ Flood ○ Ring Oil 1
- ☐ Flinger ☐ Purge Oil Mist ○ Oil Mist
- ○ Constant Level Oiler ○ Pressure
- ○ 1/2" NPS min. Oil Fill & Drain (2.8.2.4)
- ○ Oil Viscosity ISO Grade:
- ○ Oil Heater- ○ Electric ○ Steam
- ○ Oil Pressure to be Greater than Coolant Pressure

VIBRATION DETECTORS ○ See attached API-670 Data Sheet

- ○ Type: ○ API 670
- ○ Mfr: ☐ Model:
- ○ No. at each Shaft Bearing: Total No.:
- ○ Oscillator - Detectors Supplied by:
  ○ Mfr.: ☐ Model:
  Monitor Supplied by (3.2.4.6):
  ○ Location: Enclosure:
  ○ Mfr.: ☐ Model:
  ☐ Scale Range ☐ Alarm set @ μm
  ○ Shutdown- Set @ μm ○ Time Delay: sec.

AXIAL POSITION DETECTORS Note 3 ○ See attached API-670 Data Sheet 1

- ● Type: Accelerometer ● No. Required 1
- ● Mfr: Bently Nevada ☐ Model:
- ○ Oscillator - Demodulator Supplied by:
  ○ Mfr.: ☐ Model:
  ○ Monitor Supplied by (3.2.4.6): Others
  ● Location: FAR Enclosure:
  ● Mfr.: Bently Nevada ■ Model: 3500
  ☐ Scale Range ☐ Alarm set @ μm
  ○ Shutdown- ☐ Set @ μm ○ Time Delay: sec.

REMARKS:

Note 1 Compressor casing welding and NDE shall comply with JAC-WE-00-SS-011.

Note 2 '100% LPI is required for compressor impeller, 10%PMI is requred for impeller vanes and impeller weld joints'. 1

Note 3 Accelerometer is not required for spare compressor.

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CUSTOMER CONNECTIONS

	☐ No.	■ Size	■ Facing	■ Rating	☐ Position	■ Flanged Studded or Threaded (2.3)	○ Mating Ring & Gasket by Vendor (2.3.8.4)
System Inlet		8"	RF	ANSI B 16.5		Flanged	
System Discharge		6"	RF	ANSI B 16.5		Flanged	
Machine Inlet		8"	RF	ANSI B 16.5		Flanged	
Machine Discharge		6"	RF	ANSI B 16.5		Flanged	
Machine Drain		1"	RF	ANSI B 16.5		Flanged	
Cooling Water		4"	RF	ANSI B 16.5		Flanged	
Ring Liquid Inlet		2"	RF	ANSI B 16.5		Flanged	
Vents							

☐ **ALLOW. FORCES AND MOMENTS ON LIQUID RING MACHINE**

	Inlet		Discharge			
	Force	Mom't	Force	Mom't	Force	Mom't
	kg.	kg.m.	kg.	kg.m.	kg.	kg.m.
Axial	10000	3000	7500	2000		
Vertical	6000	3000	5000	2000		
Horiz. 90°	6000	3000	5000	2000		

	Inlet		Discharge			
	Force	Mom't	Force	Mom't	Force	Mom't
	kg.	kg.m.	kg.	kg.m.	kg.	kg.m.
Axial						
Vertical						
Horiz. 90°						

☐ **WEIGHTS (Kgs)**

Liquid Ring Machine: 3500 Driver:
Separator
Complete Unit:
Max. Maintenance:
Total shipping:

☐ **SPACE REQUIREMENTS (Millimeters)**

	Length	Width	Height
Complete Unit			
Liq. Ring Machine & Driver	5000	1150	2000
Separator Vessel			

COUPLINGS AND GUARDS

Coupling - Type: Spacer type
Mfr / Model No. Rexnord - Thomas
Furnished by: Compressor Vendor
■ Spacer Length (mm): TBD Rating (kW/1000 rpm):
☐ Limited End Float Required (3.4.8)
Guard Type: ○ Fully Enclosed ○ Semi-open ● Non-spark
○ Furnished by: Compressor Vendor
○ Vendor Mount Half Coupling
○ Dynamically Balanced (3.4.7)

○ See Attached API-671 Data Sheet
Lubricating Requirements:
● Non-Lube ○ Grease ○ Other
☐ Belt Drive
☐ Belt Type / No.:
☐ Belt Mfr.:
☐ Belt Service factor (3.5.1)
○ ISO Grade 6.3 Sheave Balance (3.5.4.7)

MOUNTING PLATES

● Baseplates furnished by (3.6.1.1):
○ Machine and driver ● Complete System
○ Drip Rim (3.6.2.6) ○ Machine & Driver
○ For Complete System
○ Column Mounting (3.6.1.1) ○ Sub-Sole Plates Reqd.
○ Continuously Grouted (3.6.1.1) ○ Leveling Pads (3.6.2.3)
☐ Stainless Steel Shim Thickness:
○ Primer for Epoxy Grout Required (3.6.1.2.5)
Type:
○ Machine Mounting Pads (3.6.2.9)
○ Non-Skid Decking (3.6.2.10)

○ Sole Plates furnished by:
For: ○ Machine ○ Driver ○ Other
☐ Thickness: millimeters
○ Sub-Sole Plates Required
○ Leveling (Chock) Blocks Required
☐ Stainless Steel Shim Thickness: millimeters
○ Primer for Epoxy Grout Required (3.6.1.2.5)
Type:

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MECHANICAL SEAL / PACKING

Seal Data

- ○ Special Data Sheet:
- ☐ API Material Class Code (Table H-4):
- ☐ Manufacturer:
- ☐ Size and Type:
- ☐ Manufacturer Code:

Packing Data -

- ☐ Manufacturer:
- ☐ Type:
- ☐ Size and No. of Rings:
- ☐ Packing Injection Required
- ☐ Flow: (m³/hr) @ (barg)
- ☐ Lantern Ring:
- ☐ Max. Sealing Pressure: (barg)

Seal Construction -

- ○ No Sleeve
- ○ Pumping Ring
- ● Cartridge Mount
- ○ Hooked Sleeve or Non-cartridge
- ☐ Sleeve Material:
- ☐ Gland Material:
- ○ Auxiliary Seal Device:
- ☐ Jacket Required

Gland Taps:

- ■ (F)lush ☐ (D)rain ☐ (B)arrier
- ☐ (C)ooling ☐ (V)ent
- ☐ (H)eating ☐ (Q)uench
- ☐ Fully Confined Gland Plate Gasket (2.6.11)

SEALING FLUIDS DATA

Seal Fluids -

Note: If flush liquid is pumpage liquid (as in flush piping plans 11 to 41), following flush liquid data is not required.

- ○ Temperature (°C) - Supply: Min: Max:
- ○ Specific Gravity: @ °C
- ○ Name of Fluid:
- ○ Specific Heat: Kcal/Kg°C
- ○ Vapor Pressure: bara @ °C
- ○ Toxic ○ Flammable ○ Other:
- ☐ Flow Rate (m³/hr) - Max: Min:
- ☐ Required Press.(barg) Max: Min:
- ☐ Required Temp. (°C) - Max: Min:

Quench Fluid -

- ○ Name of Fluid:
- ○ Flow Rate: (m³/hr)

Barrier Fluid -

- ○ Temperature (°C) Supply: Min: Max:
- ○ Specific Gravity: @ °C
- ○ Name of Fluid:
- ○ Specific Heat: Kcal/Kg°C
- ○ Vapor Pressure: bara @ °C
- ○ Toxic ○ Flammable ○ Other:
- ☐ Flow Rate (m³/hr) - Max: Min:
- ☐ Required Press.(barg) Max: Min:
- ☐ Required Temp. (°C) - Max: Min:

SEAL FLUSH PIPING

Plan: 54	○ Tubing	○ Carbon Steel	○ Type Tube Fittings:
	○ Pipe	○ Stainless Steel	○ Flow indicator (Plan 52/53)
Auxiliary Plan:	○ Tubing	○ Carbon Steel	○ Heat Exchanger (Plan 52/53)
	○ Pipe	○ Stainless Steel	○ Pressure Switch (Plan 52/53)
Piping Assembly:	○ Threaded	○ Seal Welded	○ Pressure Gauge (Plan 52/53)
○ Unions	○ Flanged	○ Socket Welded	○ Temperature Indicator (Plans 21,22,23,32,41)

COOLING WATER PIPING

- ○ Cooling Water Plan:
- ○ Galvanized Piping Required ○ Inlet Valve
- ○ Copper Tubing Required ○ Outlet Valve
- ○ Stainless Steel Tubing Req'd ○ Sight Flow Indicators

☐ Cooling Water Requirements -	Flow(m³/hr)	Temp (°C)
Seal Jacket/Bearing Housing		
Seal Heat Exchanger		
Ring Liquid Cooler		
Total Cooling Water		

PIPING SYSTEMS (3.7)

○ Vapor Inlet Piping (3.7.1.14)	○ LRVP Discharge Piping	● Ring Liquid Piping
○ Pressure Control Valve	○ Check Valve ○ Block Valve	○ Automatic Shut-Off Valve ○ Block Valves
○ Check Valve ○ Ejector	○ Relief Valve:	● Make-up Control valve ○ Make-up Piping
○ Block Valve	Set Press. barg	● Drain Piping ○ Drain Trap ● Y-Type Strainer
○ Material: ○ Steel	○ Material ○ Steel	○ Cartridge Type Filter ○ Duplex ○ Switch Valve
● SS ○ Other:	● SS ○ Other:	○ Material: ○ Steel ● SS ○ Other:

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SEPARATOR (3.1.2)

● Inspection ○ Spot Radiography ● Hydrotest
○ Surface ● Other: Note (1)
● ASME Design ● With Stamp ○ Without Stamp
○ Other:
● Corrosion Allowance (mm) 0.4
○ Horizontal ○ Vertical
○ Max. Allowable Liquid Carry-over:
○ Separator Liquid drain to at barg

SEPARATOR MATERIALS

	Description	ASTM Number
● Shell	Stainless steel	316L
● Heads	Stainless steel	316L
● Demister	Stainless steel	316L
● Nozzles	Stainless steel	316L
● Flanges	Stainless steel	316L
● Internals	Stainless steel	316L
○ Gaskets		

CONNECTIONS

	No.	Size	Rating/Facing/Type
Inlet			
Outlet			
Vent			
Drain			
Instruments			
Relief Valve			

All connections 38 mm (1-½") and larger shall be flanged.

☐ Diameter (mm): ☐ Length (mm):
☐ Thickness - Shell / Head (mm):
☐ Clean Pressure Drop (Flange to Flange - barg):
☐ Gas Vertical Velocity (m/sec.):
☐ Max. Allowable working Pressure: barg @ °C
☐ Minimum Design Metal Temperature: °C @ barg
☐ Hydrotest pressure (barg):
☐ Support Method: ☐ Legs ☐ Skirt ☐ Saddles

Remarks:

Note (1) All welds 100% radiography.

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INSTRUMENTATION

● Process Control Method:	Signal - Source:
○ Suction Throttling from to bara	Type: ○ Electronic, Range to mA
● Speed Variation from to %	○ Pneumatic to barg
○ Discharge Blow-off to	○ Other:
● Bypass from Discharge to Inlet	Instrument Mounting:
	○ Local Panel ○ Remote Panel
	● Locally (On Pipe or Equipment on Local Gage Board)

INSTRUMENT SUPPLIERS

	Manufacturer	Size	Type
Pressure Gages			
Temperature Gages			
Level gages			
Diff. Pressure Gages			
Pressure Switches			
Diff. Pressure Switches			
Temperature Switches			
Level Switches			
Control Valves			
Pressure Relief Valves			
Thermal Relief Valves			
Sight Flow Indicators			
Flow Switches			
Vibrations Equipment			
Constant Level Oilers			
Solenoid Valves			
Annunciator			

PRESSURE GAGE REQUIREMENTS

	Locally Mounted	Local Panel	Remote Panel
1st Stage Inlet	○☐	○☐	○☐
2nd Stage Inlet	○☐	○☐	○☐
1st Stage Discharge	●☐	○☐	○☐
2nd Stage Discharge	○☐	○☐	○☐
1st Stage Liq. Ring Inlet	●☐	○☐	○☐
2nd Stage Liq. Ring Inlet	○☐	○☐	○☐
Other:	○☐	○☐	○☐

TEMPERATURE GAGE REQUIREMENTS

	Locally Mounted	Local Panel	Remote Panel
1st Stage Inlet	○☐	○☐	○☐
2nd Stage Inlet	○☐	○☐	○☐
1st Stage Discharge	○☐	○☐	○☐
2nd Stage Discharge	○☐	○☐	○☐
1st Stage Liq. Ring Inlet	●☐	○☐	○☐
2nd Stage Liq. Ring Inlet	○☐	○☐	○☐
Other:	○☐	○☐	○☐

ALARM & SHUTDOWN SWITCHES (3.2.5.1) (TABLE 2)

	Pre-Alarm	Shutdown
○ High Gas Discharge Temp.	●	●
○ High Liq. Ring Outlet Temp.	●	○
○ High Gas Outlet Pressure	●	●
○ Low Ring Liquid Flow	●	○
○ Low Ring Liquid Level	●	○

	Pre-Alarm	Shutdown
○ High Ring Liquid Level	●	○
○ High Vibration	●	○
○ Low Mech. Seal Fluid Press.	○	○
○ Panel Purge Failure	○	○

Remarks:

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Dresser-Rand

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INSTRUMENTATION (Cont'd)

Switch Closures:

Alarm Contacts Shall: ○ Open ○ Close to Sound Alarm and be Normally: ○ Energized ○ De-Energized

Shutdown Contacts Shall: ○ Open ○ Close to Trip and be Normally: ○ Energized ○ De-Energized

Note: Normal Condition is when Liquid Ring Machine is in Operation

MISC. INSTRUMENTATION

○ Ring Liquid Sight Flow Indicator
○ Ring Liquid Level Gage
○ Vibration & Shaft position Probes & Oscillator-Demodulators
○ Vibration & Shaft Position Readout Equipment
Vibration Readout Location:
☐ Local Panel ☐ Separate Panel ☐ Control Room
○ Annunciator System
○ Panel & Annunciator Purge
○ Instrument Block Valves (Except Shutdown Instruments)
○ Instrument Block Valves for Shutdowns
○ Liquid Filled Pressure Gages
○ Alarm Horn & Acknowledgement Switch
○ Test Lamp Pushbutton
○ Permissive Start with Pilot Light
○ Pilot Light Incoming Circuits
○ Start-Stop Switches
○ Bearing Metal Temp. Sensors (2.8.2.7)
○ Radial - Number: ○ Axial - Number:
○ Pre-Alarm & Shutdown Switches Shall be Separate
○ Electrical & Instrument Connections within the Confines of the Base Shall be Brought out to Terminal Boxes

MISCELLANEOUS

○ Anti-Fungal Protection & Corrosion Resistant Coatings for Electrical materials (3.2.6.6)
○ Thermal Relief valves
○ Ring Liquid Level Control Valve
○ Review of Purchaser's Piping (3.7.1.15) & Foundation
○ Review of Purchaser's Control System
○ Dynamic Rotor Balancing (ISO Grade: _____)
○ Special Skid Clearance for Safe Access Areas (2.1.7):

● Air Run-in Required (2.1.14)
○ Spare Rotor Required (4.4.2.8)
○ Units of Measure (Dwgs, Nameplates, etc.)(2.10.3):

○ 5 Yr. Retention of Final Assembly Clearances (4.2.1.1.e)
○ Co-ordination Meeting Required (5.1.3)

INSPECTION & TESTING

	Req'd	Witness	Obs.
Shop Inspection	●	○	●
Cleanliness (4.2.3.2)	●	○	●
QC Program Review (4.1.7)	●	○	●
Hydrostatic	●	○	●
Mech. Run - LR Machine	●	○	●
☐ Contract Coupling ☐ Idling Adaptor(s)			
☐ Contract Probes ☐ Shop Probes			
○ Max/Min. Press. Ratio (2.7.2.3)			
○ Max/Min. Capacity (2.7.2.3)			
Vibration Spectrum Plot (4.3.3.3.2)	○	○	○
Vibration Recording (4.3.3.3.3)	○	○	○
Cont. Plot of Speed, Vibration, Phase Angle (4.3.3.5.2)	○	○	○
Seismic Vibration Data (4.3.3.5.4)	○	○	○
Critical Speed Verification (4.3.3.5.6)	○	○	○
4 Hr. Mech. Run (4.3.3.5.7)	●	●	○
Mech. Run Spare Rotor	○	○	○
Ring Stability Test (4.3.6.4)	○	○	○
Panel Functional Test	○	○	○
Gas Leak Test Disch. Press. (4.3.4)	○	○	○
○ Before ○ After Mechanical Run			
Performance Test	●	●	○
Contract Liquid Ring System	○	○	○
Complete Unit Test (4.2.3.3)	○	○	○
Hardness Tests (4.2.3.3)	○	○	○
Gear Test (4.3.6.2)	●	○	●
Sound Level Test (4.3.6.3)	○	○	○

● Advance Notice Req'd: Days (4.1.4) (4.3.1.3)
○ Inspection Checklist Req'd (4.1.6)

TOTAL UTILITY CONSUMPTION

Cooling Water	m^3/hr
Steam, Normal:	kg/hr
Steam, Max:	kg/hr
Instrument Air	m^3/hr
kW (Driver):	kW
kW (Auxiliaries):	kW
Heaters:	kW
Purge (Air or Nitrogen):	m^3/hr

Remarks:

FLUOR,

LIQUID RING VACUUM PUMP AND COMPRESSOR SYSTEM DATA SHEET

Contract:	A2WT
Item No.:	15-C-1102
Unit:	15
P.O. No.:	15-ME-PO-43C02-03
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RING LIQUID COOLER Note (3)

Duty: Cooler Item Number:

Supplier: No. Units Required:

Model Number: Type:

OPERATING CONDITIONS

	Shell Side	Tube Side
● Fluid	15 Deg brine	Compressor seal fluid(90% Aceticacid)
☐ Total Flow (kg/hr)		
☐ Specific Gravity	@ °C	@ °C
☐ Thermal Conductivity (kcal / hr x m² x °C)	@ °C	@ °C
☐ Specific Heat (kcal / kg x °C)	@ °C	@ °C
☐ Viscosity (cP)	@ °C	@ °C
☐ Operating Temperature (°C)	IN OUT	IN OUT
Inlet Pressure (kPa)		
Inlet Velocity (m / sec.)		
○ Pressure Drop (bar)	ALLOW. CALC.	ALLOW. CALC.
☐ Design Temperature (°C)		
Pressure (bar)	MIN. TEST	MIN. TEST
Fouling Resistance (m² K/W)	0.0002	
● Min. Corrosion Allowance (mm)	3	0.4
☐ Number of Passes per Shell		

CONSTRUCTION DETAILS

☐ Total Area (1) (Sq. Meters):	☐ Shell: No. x ID x mm
☐ LMTD:	☐ Tubes - No. per Shell:
☐ Corrected MTD:	☐ O.D. x Length (mm) x (mm)
☐ Transfer Rate (Clean):	☐ Gauge - BWG: (Avg. Min. Wall)
☐ Transfer Rate (service):	☐ Tube Pitch: (mm) △ ○ ☐
☐ Cross Baffles - Type:	☐ Removable Tube Bundle ☐ Yes ☐ No
○ Code Requirements: ○ ASME ● TEMA: R	● Code Stamp: ☐ Yes ☐ No
☐ Weight (kg) - Each Bundle: Bundle & Shell:	Full of Water:

☐ NOZZLE SIZES

	Shell Side			Tube Side		
	No.	Size	Rating & Facing	No.	Size	Rating & Facing
Inlet						
Outlet						
Drain						
Vent						

○ MATERIALS

Tubes: 316L SS	Baffles: CS
Tube Sheets: 316L SS	Channel: 316L
Shell: CS	Channel Flanges: 316L
Shell Flanges:	Channel Nozzle Flanges 316L

Remarks: 1) Outside tube area excluding area in tube sheets.

2) Units exempt from code stamp shall have longitudinal weld seams spot examined per Para UW-52 of ASME code.

3) All welds 100% radiography.