

ITM Task Description		Freque	ncy	ITM Task		ncy	
Inspection	Screw	Recip	Rotary Vane	Inspection	Screw	Recip	Rotary Vane
a) Runtime hours	WA-D	WA-D	WA-D	q) Drive guard in place	D	D	D
b) Suction pressure	D	D	D	r) Foundation solid, in place, and free from evidence of deterioration	А	А	А
c) Discharge pressure	D	D	D	D s) Visually inspect mounting bolts		А	А
d) Oil pressure	D	D	D	are in place			
e) Oil temperature	D	WA-D	D	t) Visually inspect metal surfaces for pitting or surface damage	A	A	A
f) Discharge temperature	D	WA-D	D	u) Visually inspect coupling for wear	А	WA-A	WA-A
g) Verify oil levels are adequate	D	D	D	v) Visually inspect starter	А	А	А
h) Oil filter differential pressure	D	WA-D	NA	connections and associated timers and relays			
i) Oil leaks	D	D	D	w) Operation of oil heaters	А	А	А
j) Lubricator oil level and drip rate	NA	NA	D	x) Operation of unloader	М	М	М
k) Jacket cooling oil level	NA	NA	D	y) Visually inspect alignment of	А	А	A
I) Determine shaft seal leak rate	WA-W	WA-W	WA-W	compressor-motor drive shaft	Saray	Decin	Potory Vono
m) Indicator of Compressor Capacity	D	WA-D	WA-D	Testing	Sciew	Recip	Rolary valle
n) Motor amperage (current)	D	WA-D	WA-D	Test safety shutdowns:			
o) Recorded Alarms and Shutdowns	D	WA-D	WA-D	a) Low suction pressure cutout	A	A	A
 p) Free from abnormal sounds and excessive vibration 	D	D	D	b) High discharge pressure cutout (HPCO)See Section 6.1.1	A	A	A





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a) Runtime hours	WA-D	WA-D	WA-D	q) Drive guard in place	D	D	D
b) Suction pressure	D	D	D	r) Foundation solid, in place, and free from evidence of deterioration	А	А	А
c) Discharge pressure	D	D	D	D s) Visually inspect mounting bolts		А	А
d) Oil pressure	D	D	D) are in place			
e) Oil temperature	D	WA-D	D	t) Visually inspect metal surfaces for pitting or surface damage	A	A	A
f) Discharge temperature	D	WA-D	D	u) Visually inspect coupling for wear	А	WA-A	WA-A
g) Verify oil levels are adequate	D	D	D	v) Visually inspect starter	А	А	А
h) Oil filter differential pressure	D	WA-D	NA	connections and associated timers and relays			
i) Oil leaks	D	D	D	w) Operation of oil heaters	А	А	А
j) Lubricator oil level and drip rate	NA	NA	D	x) Operation of unloader	М	М	М
k) Jacket cooling oil level	NA	NA	D	y) Visually inspect alignment of	А	А	А
I) Determine shaft seal leak rate	WA-W	WA-W	WA-W	compressor-motor drive shaft	0	Desim	DeterryMana
m) Indicator of Compressor Capacity	D	WA-D	WA-D		Screw	кесір	Rotary vane
n) Motor amperage (current)	D	WA-D	WA-D	Test safety shutdowns:			
o) Recorded Alarms and Shutdowns	D	WA-D	WA-D	(a) Low suction pressure cutout	A	A	A
 p) Free from abnormal sounds and excessive vibration 	D	D	D	b) High discharge pressure cutout (HPCO) See Section 6.1.1	A	A	A



Testing Compressor Safeties [§6.1.1]

- The function of the high discharge pressure shutdown safety device shall be tested by one of the following methods based on the type of device being used:
 - Electromechanical Switch [§6.1.1.1]
 - Pressure Transducer or Transmitter Connected to an Electronic Controller [§6.1.1.2]









Electromechanical Switch [§6.1.1.1]

- Functional testing of an electro-mechanical switch as a high-pressure limiting device requires proof of the three following characteristics:
 - o 1. Function of the device to shut down an operating compressor.
 - 2. Function test setpoint shall be no more than 90% of the relief valve setting.
 - O 3. Calibration of the device to show it functions within an accuracy of +/ 2.5% at the setpoint when compared to a pressure standard or a master gauge.



Electromechanical Switch [§6.1.1.1]

- Permitted Test Methods:
 - o 1. Manipulation of discharge pressure to the cutout set point.
 - o 2. Use of a check valve, a bleed valve, and an external pressure source.

• Nonpermitted Test Methods:

- o 1. Removal and bench testing of the switch.
- o 2. Isolation of a shutdown compressor, followed by pressurization.
- o 3. Reduce the cutout set point.



Pressure Transducer [§6.1.1.2]

- Functional testing of a pressure transducer or transmitter connected to an electronic controller as a pressure-limiting device requires proof of the three following characteristics:
 - I. Function of the device to shut down an operating compressor after sensors are calibrated.
 - o 2. Setpoint shall be no more than 90% of the relief valve setting.
 - O 3. Calibration of the device to show it reads pressure within an accuracy of +/- 2.5% at the set point or at two pressures chosen to verify the accuracy of the calibration curve programmed into the controls, when compared to a pressure standard or a master gauge.



Pressure Transducer [§6.1.1.2]

- Permitted Test Methods:
 - o 1. Manipulation of discharge pressure to the cutout set point.
 - 2. Reduce the cutout set point and raise the discharge pressure until shutdown occurs.
 - o 3. Using a check valve, a bleed valve, and an external pressure source.
- Nonpermitted Test Methods:
 - o 1. Removal and bench testing of the pressure transducer or transmitter.
 - o 2. Isolation of a shutdown compressor, followed by pressurization.



A.6.1.1.2 Figure 1



A.6.1.1.2 Figure 2



Normal Operation











Normal Operation

ITM Task Description		Freque	ncy	ITM Task	Frequency					
Testing	Screw	Recip	Rotary Vane	Maintenance	Screw	Recip	Rotary Vane			
c) High discharge temperature cutout	A	WA-A	A	h) Replace shaft seal	When maximum pre-determined leak rate is approaching or					
d) Low oil pressure cutout	А	А	А		A and Align when maximum pre- determined alignment parameters are exceeded					
e) High liquid level cutout	A	A	А	i) Measure (hot) compressor-motor drive shaft alignment						
Maintenance	Screw	Recip	Rotary Vane	i) Lubricate compressor and external	W/A-S		WA-S			
a) Add Oil		As Nee	ded	oil pump electric motor bearings	WA-0	WA-0	WA-0			
b) Change oil filter	As indica	ted by ∆P oil analysi	, runtime hours, s, or A	k) Remove electrical connection box cover and visually inspect insulation	A	A	A			
c) Clean external oil pump suction strainer	WA-5	WA-5	WA-5	I) Verify integrity of control panel	A	A	A			
d) Oil Analysis - Take oil sample and	A	or runtim	e hours	power supply and control circuit electrical connections						
qualified testing lab [Not required if oil is changed on an Annual (A) frequency or a determined runtime				m) Verify integrity of starter connections and associated timers and relays	A	A	A			
hours frequency]				n) Calibrate pressure and	WA-A	WA-A	WA-A			
e) Align external oil pump shaft	WA-5	WA-5	WA-5	temperature cutout devices (found in the previous Testing Section)						
f) Change oil	As indicated by oil analysis, predetermined runtime, or A			o) Inspect for rotor axial play in motor-driven rotor shaft	А	WA-A	NA			
g) Verify coupling bolts are in place	А	А	A	p) Inspect pistons, rings, and plate	NA	WA-5	NA			
				valves		or hours				







ITM Task Description		Freque	ncy	ITM Task	Frequency					
Testing	Screw	Recip	Rotary Vane	Maintenance	Screw	Recip	Rotary Vane			
c) High discharge temperature cutout	A	WA-A	A	h) Replace shaft seal	When maximum pre-determined leak rate is approaching or					
d) Low oil pressure cutout	А	А	А							
e) High liquid level cutout	A	A	А	drive shaft alignment	determined alignment parameters are exceeded					
Maintenance	Screw	Recip	Rotary Vane	i) Lubricate compressor and external	\M/A-S		WA-S			
a) Add Oil		As Nee	ded	oil pump electric motor bearings	WA-0	WA-0	WA-0			
b) Change oil filter	As indica	ted by ∆P oil analysi	, runtime hours, s, or A	k) Remove electrical connection box cover and visually inspect insulation	A	A	А			
c) Clean external oil pump suction strainer	WA-5	WA-5	WA-5	I) Verify integrity of control panel	A	A	A			
d) Oil Analysis - Take oil sample and	A	or runtim	e hours	power supply and control circuit electrical connections						
qualified testing lab [Not required if oil is changed on an Annual (A) frequency or a determined runtime				m) Verify integrity of starter connections and associated timers and relays	A	A	A			
hours frequency]				n) Calibrate pressure and	WA-A	WA-A	WA-A			
e) Align external oil pump shaft	WA-5	WA-5	WA-5	temperature cutout devices (found in the previous Testing Section)						
f) Change oil	As indicated by oil analysis, predetermined runtime, or A			o) Inspect for rotor axial play in motor-driven rotor shaft	А	WA-A	NA			
g) Verify coupling bolts are in place	А	А	A	p) Inspect pistons, rings, and plate	NA	WA-5	NA			
				valves		or hours				



ITM Task Description		Freque	ncy	ITM Task	Frequency					
Testing	Screw	Recip	Rotary Vane	Maintenance	Screw	Recip	Rotary Vane			
c) High discharge temperature cutout	A	WA-A	A	h) Replace shaft seal	When m leak r	aximum p ate is app	re-determined roaching or			
d) Low oil pressure cutout	А	А	А							
e) High liquid level cutout	A	A	А	i) Measure (hot) compressor-motor drive shaft alignment	determined alignment parameters are exceeded					
Maintenance	Screw	Recip	Rotary Vane	i) Lubricate compressor and external	W/A-S		WA-S			
a) Add Oil		As Nee	ded	oil pump electric motor bearings	WA-0	WA-0	WA-0			
b) Change oil filter	As indica	ted by ∆P oil analysi	, runtime hours, s, or A	k) Remove electrical connection box cover and visually inspect insulation	A	A	А			
c) Clean external oil pump suction strainer	I oil pump suction WA-5 WA-5 WA-5 I) Verify integrity of control pane		I) Verify integrity of control panel	А	А	A				
d) Oil Analysis - Take oil sample and	А	or runtim	e hours	electrical connections						
qualified testing lab [Not required if oil is changed on an Annual (A) frequency or a determined runtime				m) Verify integrity of starter connections and associated timers and relays		A	A			
hours frequency]				n) Calibrate pressure and	WA-A	WA-A	WA-A			
e) Align external oil pump shaft	WA-5	WA-5	WA-5	temperature cutout devices (found in the previous Testing Section)						
f) Change oil	Change oil As indicated by oil analysis, predetermined runtime, or A		oil analysis, runtime, or A	o) Inspect for rotor axial play in motor-driven rotor shaft	А	WA-A	NA			
g) Verify coupling bolts are in place	A A A		A	p) Inspect pistons, rings, and plate	NA	WA-5	NA			
				valves		or hours				





ITM Task Description		Freque	ncy	ITM Task	Frequency					
Testing	Screw	Recip	Rotary Vane	Maintenance	Screw	Recip	Rotary Vane			
c) High discharge temperature cutout	A	WA-A	А	h) Replace shaft seal	When m leak r	aximum p ate is app	pre-determined proaching or			
d) Low oil pressure cutout	А	А	А							
e) High liquid level cutout	A	A	А	drive shaft alignment	determined alignment parameters are exceeded					
Maintenance	Screw	Recip	Rotary Vane	i) Lubricate compressor and external	M/A-S		W/A-S			
a) Add Oil		As Nee	ded	oil pump electric motor bearings	WA-0	VVA-5	WA-5			
b) Change oil filter	As indica	ted by ∆P oil analysi	, runtime hours, s, or A	k) Remove electrical connection box cover and visually inspect insulation on motor leads	A	A	A			
c) Clean external oil pump suction strainer	WA-5	WA-5	WA-5	I) Verify integrity of control panel	A	A	A			
d) Oil Analysis - Take oil sample and	А	or runtim	e hours	electrical connections						
qualified testing lab [Not required if oil is changed on an Annual (A) frequency or a determined runtime	Suits fromNot required ifAnnual (A)nined runtimeand relays		m) Verify integrity of starter connections and associated timers and relays	A	A	A				
hours frequency]				n) Calibrate pressure and	WA-A	WA-A	WA-A			
e) Align external oil pump shaft	WA-5	WA-5	WA-5	temperature cutout devices (found in the previous Testing Section)						
f) Change oil	As inc prede	licated by termined r	oil analysis, runtime, or A	o) Inspect for rotor axial play in motor-driven rotor shaft	А	WA-A	NA			
g) Verify coupling bolts are in place	А	А	A	p) Inspect pistons, rings, and plate	NA	WA-5	NA			
				valves		or hours				







ITM Task Description		Freque	ncy	ITM Task	Frequency					
Testing	Screw	Recip	Rotary Vane	Maintenance	Screw	Recip	Rotary Vane			
c) High discharge temperature cutout	A	WA-A	A	h) Replace shaft seal	When m leak i	aximum p ate is app	re-determined roaching or			
d) Low oil pressure cutout	А	А	А		A and Align when maximum pre- determined alignment parameters are exceeded					
e) High liquid level cutout	А	A	А	i) Measure (hot) compressor-motor drive shaft alignment						
Maintenance	Screw	Recip	Rotary Vane	i) Lubricate compressor and external						
a) Add Oil		As Nee	ded	oil pump electric motor bearings	WA-3	VVA-3	WA-5			
b) Change oil filter	As indica	ted by ∆P oil analysi	, runtime hours, s, or A	k) Remove electrical connection box cover and visually inspect insulation	A	A	A			
c) Clean external oil pump suction strainer	WA-5	WA-5	WA-5	I) Verify integrity of control panel	A	A	А			
d) Oil Analysis - Take oil sample and	A	or runtim	e hours	electrical connections						
qualified testing lab [Not required if oil is changed on an Annual (A) frequency or a determined runtime				m) Verify integrity of starter connections and associated timers and relays		A	A			
hours frequency]				n) Calibrate pressure and	WA-A	WA-A	WA-A			
e) Align external oil pump shaft	WA-5	WA-5	WA-5	temperature cutout devices (found in the previous Testing Section)						
f) Change oil	As indicated by oil analysis, predetermined runtime, or A			 o) Inspect for rotor axial play in motor-driven rotor shaft 	A	WA-A	NA			
g) Verify coupling bolts are in place	A A A			p) Inspect pistons, rings, and plate valves	NA	WA-5 or hours	NA			



Lubricant Analysis Report

North America: +1-877-808-3750

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Historical Comments



Lubricant Analysis Report North America: +1-877-808-3750



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Lab Number: I-115134
Lab Location: Indianapolis
Data Analyst: JAS
Sampled: 02-Oct-2018
Received: 09-Oct-2018
Completed: 10-Oct-2018
Product Information
Product Information Rec
Product Name: Information Rec
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Historical Comments

ITM Task Description	Frequency					
Maintenance	Screw	Recip	Rotary Vane			
q) Inspect vanes	NA	NA	5			
r) Verify belt tension by measurement and its condition	NA	A	А			
s) Verify pulley hub conditions	NA	А	А			
t) Check electrical wiring and connections for hot spots	А	A	А			
u) Calibrate motor current transducer/transformer	А	WA-A	NA			
v) Calibrate capacity/volume (slide valve) controls	А	NA	NA			

Frequencies: D - Daily, W - Weekly, M - Monthly, Q - Quarterly, S - Semiannual, A - Annual, B - Biennial, 3 - Three Years, 5 - Five Years, 10 - Ten Years, WA - Where Applicable, NA - Not Applicable, NR - Not Required, Others as noted.







PIPE CORROSION
ANSI/IIAR 6-2019 TABLE A.11.1.1.3.1



Piping Sizes, Schedules, and Thicknesses (Carbon Steel Only)												
Pipe Size (in.) (OD)	Pipe Schedule	Nominal Thickness (in.)	*Mill Tolerance Thickness (in.)	Alert Thickness (in.)	Remaining Percentage from Nominal	Replacement Thickness (in.)	Remaining Percentage from Nominal	**Pressure T _{ain} (in.)				
0.5 (0.840)	80	0.147	0.129	0.080	54%	0.044	30%	0.011				
0.75 (1.050)	80	0.154	0.135	0.080	52%	0.046	30%	0.013				
1 (1.315)	80	0.179	0.157	0.080	45%	0.054	30%	0.017				
1.25 (1.660)	80	0.191	0.167	0.080	42%	0.057	30%	0.021				
1.5 (1.900)	80	0.200	0.175	0.090	45%	0.060	30%	0.024				
2 (2.375)	80	0.218	0.191	0.100	46%	0.065	30%	0.030				
2 (2.375)	40	0.154	0.135	0.100	65%	0.046	30%	0.030				
2.5 (2.875)	40	0.203	0.178	0.100	49%	0.061	30%	0.036				
3 (3.500)	40	0.216	0.189	0.110	51%	0.065	30%	0.044				
3.5 (4.000)	40	0.226	0.198	0.120	53%	0.068	30%	0.051				
4 (4.500)	40	0.237	0.207	0.120	51%	0.071	30%	0.057				
5 (5.563)	40	0.258	0.226	0.120	47%	0.081	31%	0.071				
6 (6.625)	40	0.280	0.245	0.130	46%	0.094	34%	0.084				
8 (8.625)	40	0.322	0.282	0.131	41%	0.119	37%	0.109				
10 (10.750)	40	0.365	0.319	0.164	45%	0.146	40%	0.136				
12 (12.750)	ST	0.375	0.328	0.194	52%	0.172	46%	0.162				
14 (14.000)	ST	0.375	0.328	0.213	57%	0.188	50%	0.178				
16 (16.000)	ST	0.375	0.328	0.244	65%	0.213	57%	0.203				
18 (18.000)	ST	0.375	0.328	0.274	73%	0.238	64%	0.228				
20 (20.000)	ST	0.375	0.328	0.305	81%	0.264	70%	0.254				
24 (24,000)	ST	0.375	0.328	0.326	87%	0.315	84%	0.305				

Adapted from Principles and Practices of Mechanical Integrity Guidebook for Industrial Refrigeration Systems. *Mill Tolerance Thickness is 12.5% less than Nominal Thickness in accordance with ASME B31.5 and ASTM specifications. **Pressure T_{min} is in accordance with ASME B31.5 (300 psi, A53 Gr A ERW, temperatures at or above -20 °F).























Nominal Thickness of a 3" Sch 80 Pipe is 0.300

60% Material Loss

Table A.11.1.3.1 Piping Sizes, Schedules, and Thicknesses (Carbon Steel Only)

Pipe Size (in.) (OD)	Pipe Schedule	Nominal Thickness (in.)	*Mill Tolerance Thickness (in.)	Alert Thickness (in.)	Remaining Percentage from Nominal	Replacement Thickness (in.)	Remaining Percentage from Nominal	**Pressure T _{nin} (in.)
0.5 (0.840)	80	0.147	0.129	0.080	54%	0.044	30%	0.011
0.75 (1.050)	80	0.154	0.135	0.080	52%	0.046	30%	0.013
1 (1.315)	80	0.179	0.157	0.080	45%	0.054	30%	0.017
1.25 (1.660)	80	0.191	0.167	0.080	42%	0.057	30%	0.021
1.5 (1.900)	80	0.200	0.175	0.090	45%	0.060	30%	0.024
2 (2.375)	80	0.218	0.191	0.100	46%	0.065	30%	0.030
2 (2.375)	40	0.154	0.135	0.100	65%	0.046	30%	0.030
2.5 (2.875)	40	0.203	0.178	0.100	49%	0.061	30%	0.036
3 (3.500)	40	0.216	0.189	0.110	51%	0.065	30%	0.044
3.5 (4.000)	40	0.226	0.198	0.120	53%	0.068	30%	0.051
4 (4.500)	40	0.237	0.207	0.120	51%	0.071	30%	0.057
5 (5.563)	40	0.258	0.226	0.120	47%	0.081	31%	0.071
6 (6.625)	40	0.280	0.245	0.130	46%	0.094	34%	0.084
8 (8.625)	40	0.322	0.282	0.131	41%	0.119	37%	0.109
10 (10.750)	40	0.365	0.319	0.164	45%	0.146	40%	0.136
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18 (18.000)	ST	0.375	0.328	0.274	73%	0.238	64%	0.228
20 (20.000)	ST	0.375	0.328	0.305	81%	0.264	70%	0.254
24 (24.000)	ST	0.375	0.328	0.326	87%	0.315	84%	0.305

Adapted from *Principles and Practices of Mechanical Integrity Guidebook for Industrial Refrigeration Systems*. *Mill Tolerance Thickness is 12.5% less than Nominal Thickness in accordance with ASME B31.5 and ASTM specifications. **Pressure T_{min} is in accordance with ASME B31.5 (300 psi, A53 Gr A ERW, temperatures at or above -20 °F).



























CONDENSERS











PIPE SUPPORTS



Relief Valves

NY Serve

CYRUS SHANK COMPANY

INSTALLATION DATE

to JAN ALL

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BOLSE BY










VENTILATION



















DETECTION







Current Step	<u>6</u>	<u>Alarm</u> <u>C</u>
Step #1	CompRm # 1	1000
Step #2	CompRm #2	1000
Step #3	CompRm # 3	1000
Step #4	CompRm #4	1000
Step #5	Pre-cool #8	50
Step #6	Pre-cool #9	50



Resource Compliance

126 W. Ventura Ct., Kingsburg, CA 9363 I resourcecompliance.com (559) 591-8898