Overview of ANSI/IIAR 6-2019

Standard for Inspection, Testing, and Maintenance of Closed-Circuit Ammonia Refrigeration Systems

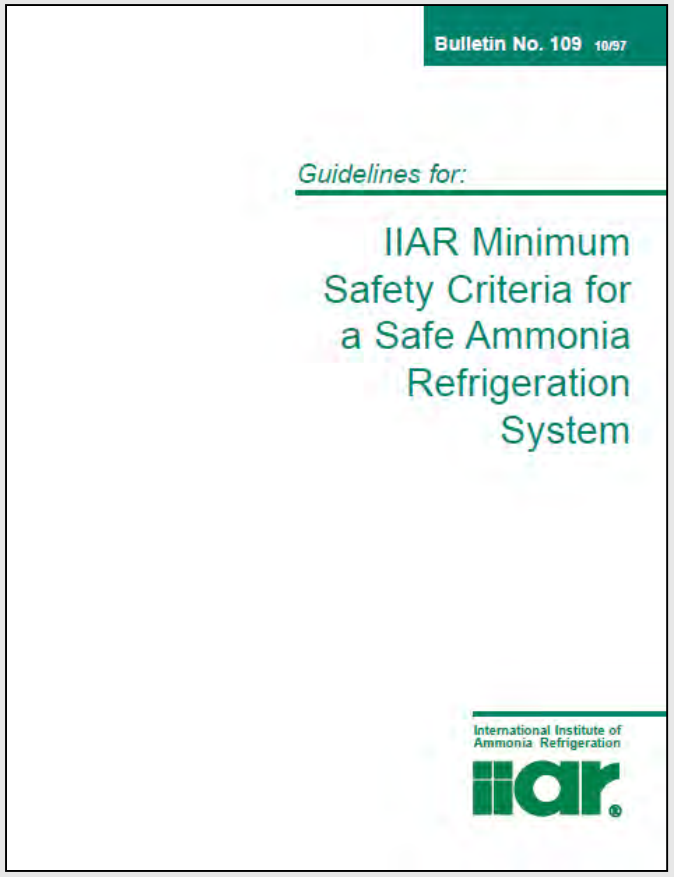
Presented by: Peter Thomas, P.E.

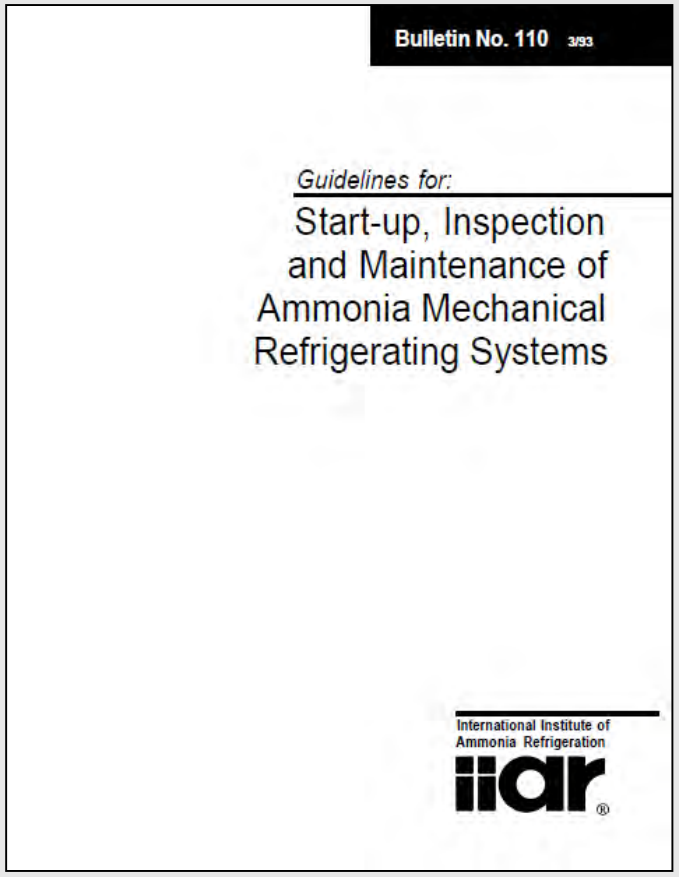
WHY STANDARD 6?

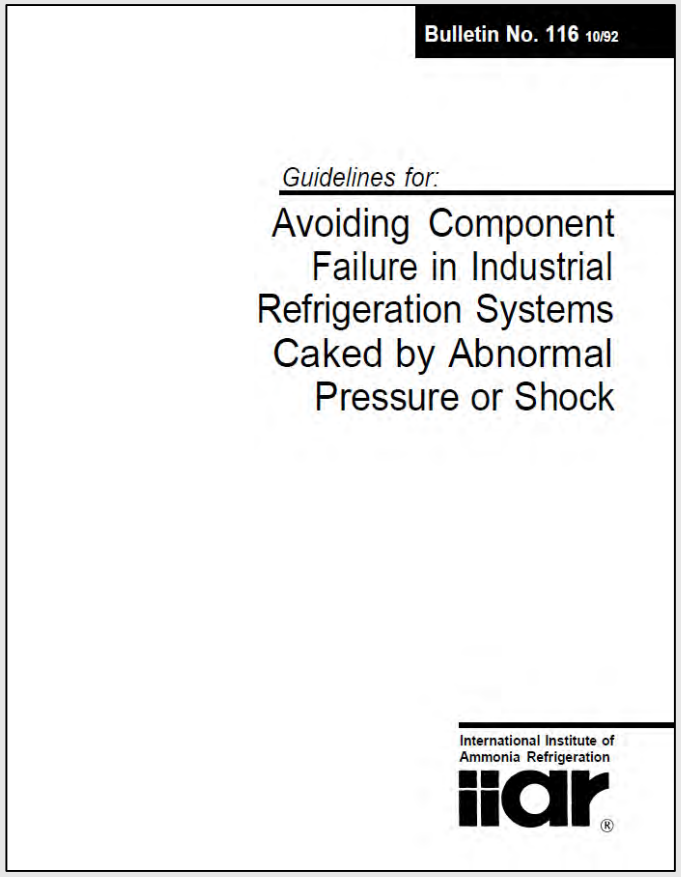
ITM

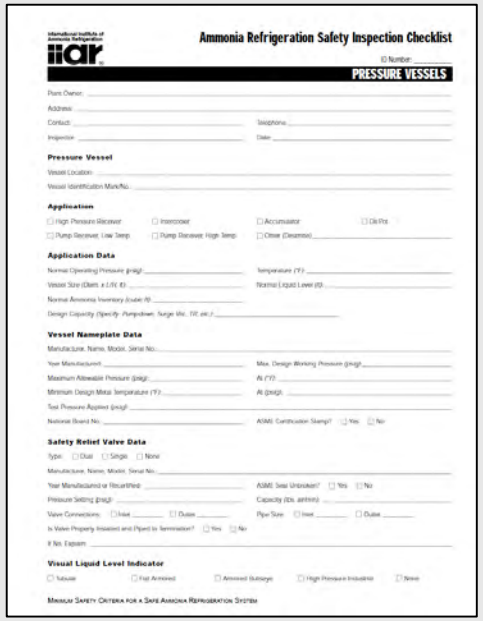
Inspection, Testing, and Maintenance

History of IIAR 6









Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

PRESSURE VESSELS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Pressure Vessel

Vessel Location: _____

Vessel Identification Mark/No.: _____

Application

☐ High Pressure Receiver ☐ Intercooler ☐ Accumulator ☐ Oil Pot

☐ Pump Receiver, Low Temp. ☐ Pump Receiver, High Temp. ☐ Other (Describe): _____

Application Data

Normal Operating Pressure (psig): _____ Temperature (°F): _____

Vessel Size (Diam. x L/H): (ft): _____ Normal Liquid Level (ft): _____

Normal Ammonia Inventory (Lbs/ft): _____

Design Capacity (Specify: Pumpdown, Surge Vol., TR, etc.): _____

Vessel Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Max. Design Working Pressure (psig): _____

Maximum Allowable Pressure (psig): _____ At (°F): _____

Minimum Design Metal Temperature (°F): _____ At (psig): _____

Test Pressure Applied (psig): _____

National Board No.: _____ ASME Certification Stamp? ☐ Yes ☐ No

Safety Relief Valve Data

Type: ☐ Dual ☐ Single ☐ None

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured or Recertified: _____ ASME Seal Unbroken? ☐ Yes ☐ No

Pressure Setting (psig): _____ Capacity (lbs. air/min): _____

Valve Connections: ☐ Inlet _____ ☐ Outlet _____ Pipe Size: ☐ Inlet _____ ☐ Outlet _____

Is Valve Properly Installed and Piped to Termination? ☐ Yes ☐ No

If No, Explain: _____

Visual Liquid Level Indicator

☐ Tubular ☐ Flat Armored ☐ Armored Sidesight ☐ High Pressure Industrial ☐ None

ID Number: _____

PRESSURE VESSELS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible and complete?	☐ Yes ☐ No			
b) Operating within limitations:				
1) Maximum pressure?	☐ Yes ☐ No			
2) Minimum temperature?	☐ Yes ☐ No			
c) Vessel ASME stamp legible?	☐ Yes ☐ No			
d) Certification drawings on file?	☐ Yes ☐ No			
e) Manufacturer data report on file?	☐ Yes ☐ No			
f) Does vessel have known alterations/modifications?	☐ Yes ☐ No			
1) If yes, was vessel recertified?	☐ Yes ☐ No			
2) Is revised data report on file?	☐ Yes ☐ No			
g) Relief valve:				
1) Proper type?	☐ Yes ☐ No			
2) Correct setting?	☐ Yes ☐ No			
3) Capacity correct?	☐ Yes ☐ No			
4) Installation correct?	☐ Yes ☐ No			
5) Piping to termination correct?	☐ Yes ☐ No			
6) Relief valve replaced or recertified within last 5 years of service?	☐ Yes ☐ No			
7) ASME seal unbroken?	☐ Yes ☐ No			
h) Tubular sight liquid level indicator (sight glass):				
1) Protected from traffic hazards?	☐ Yes ☐ No			
2) 360° guards?	☐ Yes ☐ No			
3) Valves unless breakaway?	☐ Yes ☐ No			
i) Vessel properly identified? (Name, pressure level per IIAR Bulletin 114)	☐ Yes ☐ No			

j) Vessel condition (check one): ☐ no visible corrosion ☐ slight visible corrosion ☐ extensive corrosion ☐ unknown (insulated)

k) Insulation condition (check one): ☐ no vapor retarder leaks ☐ slight vapor retarder leaks ☐ extensive vapor retarder leaks ☐ not insulated

l) Relief valve condition (check one): ☐ clean, no visible corrosion ☐ slight external corrosion ☐ extensive corrosion

Are there any other conditions that might negatively affect safe vessel operation? ☐ Yes ☐ No

If yes, describe: _____

Bulletin No. 109 10/97

Guidelines for:

IIAR Minimum Safety Criteria for a Safe Ammonia Refrigeration System

International Institute of Ammonia Refrigeration

Bulletin No. 110 3/93

Guidelines for:

Start-up, Inspection and Maintenance of Ammonia Mechanical Refrigerating Systems

International Institute of Ammonia Refrigeration

iiar®

Revision to Bulletin 110

(Approved by IIAR Board of Directors June 19, 2007)

6.6.3 Pressure Relief Devices

Pressure-relief devices are generally one of two types: rupture discs or spring-loaded valves. Rupture discs are membranes that open at a set pressure and cannot reseal. Once ruptured, these devices must be replaced.

Spring-loaded relief valves open to relieve pressure when a set pressure is exceeded. After opening, these valves are designed to re-seat when pressure in the protected component drops below the valve's closing pressure. If a spring-loaded relief valve opens, the valve shall be replaced or recertified in a safe and timely manner. If re-seating is not complete, the valve shall be taken out of service immediately.

Relief valve vent lines shall be visually inspected annually to ensure that the vent line piping is intact and that vent outlets terminated to atmosphere are unobstructed and piped to prevent foreign matter from entering the vent line piping. If equipped, drip pockets shall be checked for water accumulation.

Pressure relief devices shall be replaced or recertified in accordance with one of these three options:

1) Every five (5) years from the date of installation.

   IIAR originally recommended (in 1978) that pressure relief valves be replaced every five years from the date of installation. This recommendation represents good engineering practice considering the design and performance of pressure relief devices; or

2) An alternative to the prescriptive replacement interval, i.e., five years, can be developed based on documented in-service relief valve life for specific applications using industry accepted good practices of relief valve evaluation; or

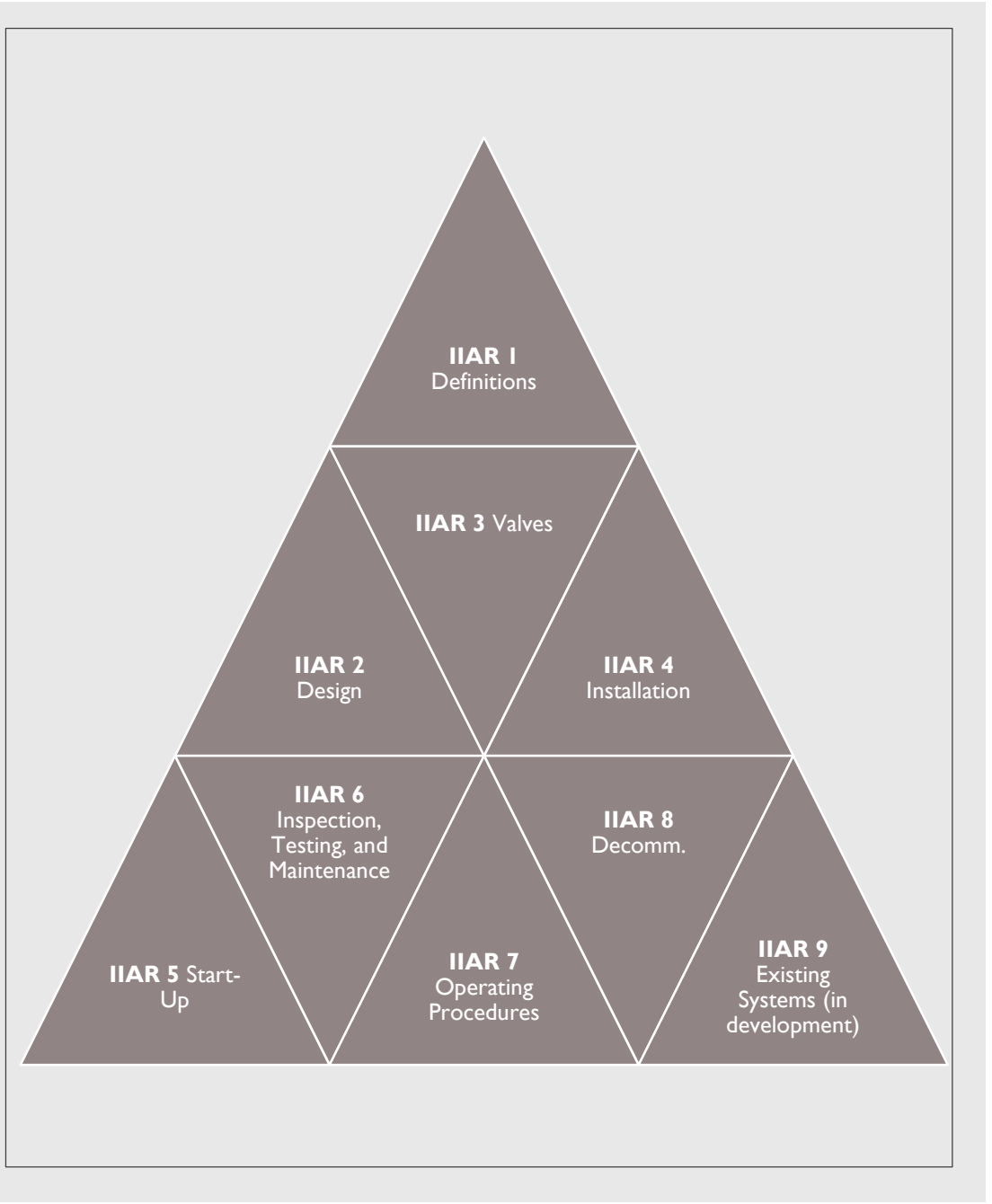
3) The manufacturer's recommendations on replacement frequency of pressure relief devices shall be followed.

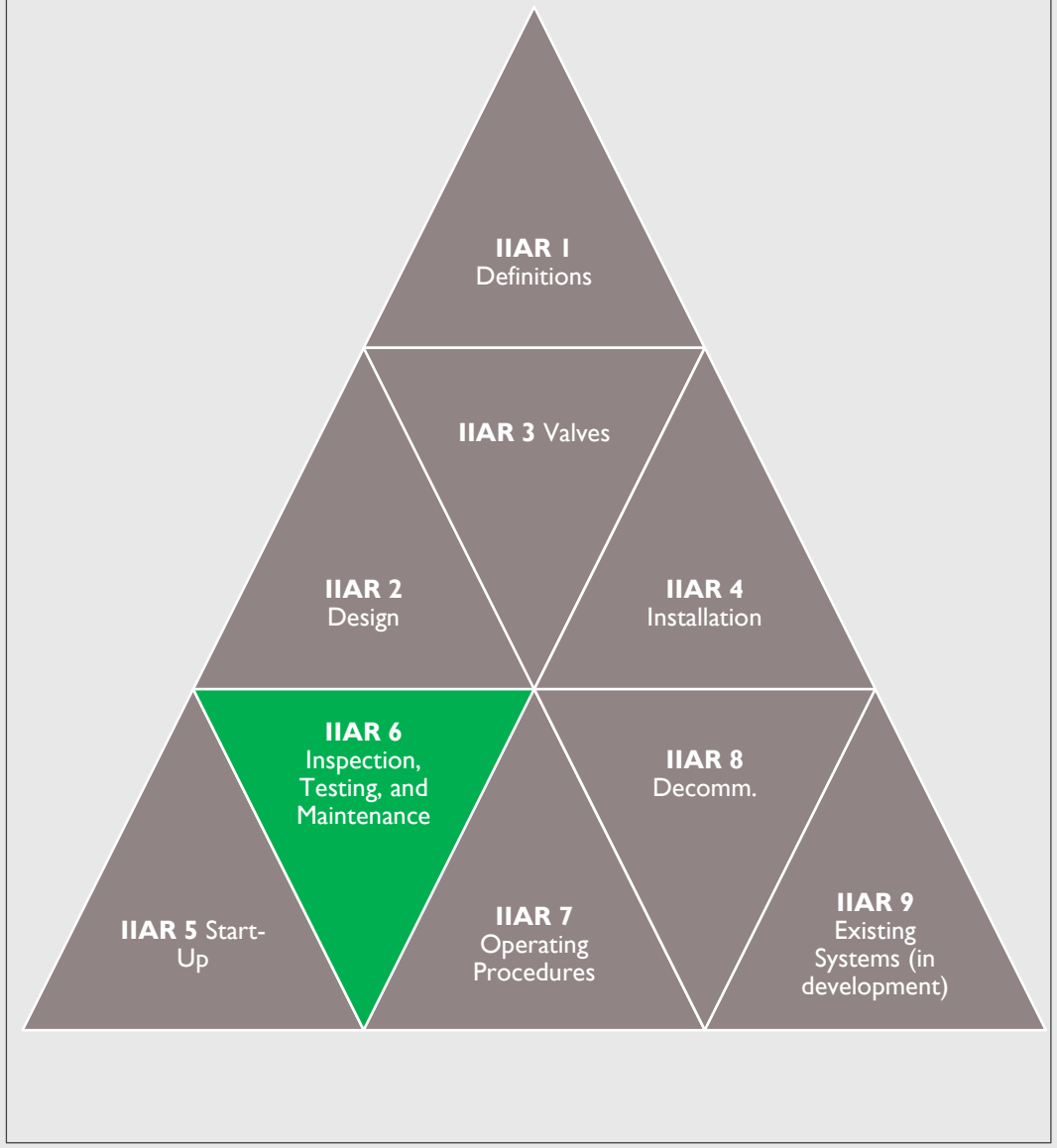
Exception: Relief devices discharging into another part of the closed-loop refrigeration system are not subject to the relief valve replacement practices.

All replacement pressure-relief devices shall be correctly selected in accordance with current editions of ANSI/IIAR 2 and ANSI/ASHRAE 15.

IIAR Bulletins

- IIAR Bulletin No. 110 §6.4.2 [emphasis mine]:
- *The system should be checked regularly for the presence of non-condensable gases which should be purged as necessary from the receiver(s) and/or condenser(s), preferably into a noncondensable gas remover or purger but alternatively into water. Where an automatic purger is fitted, its correct operation should be monitored. If there is a large accumulation of noncondensable gases the reason should be investigated and the cause should be corrected.*


IIAR 1
Definitions
IIAR 3 Valves
IIAR 2
Design
IIAR 4
Installation
IIAR 6
Inspection,
Testing, and
Maintenance
IIAR 8
Decomm.
IIAR 5 Start-
Up
IIAR 7
Operating
Procedures
IIAR 9
Existing
Systems (in
development)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IIAR 6

Part 1 – General

- 1 – Purpose, Scope, and Applic.
- 2 – Definitions
- 3 – Reference Standards
- 4 – Program Administration

Part 2 – Program Requirement

- 5 – General
- 6 – Compressors
- 7 – Pumps
- 8 – Condensers
- 9 – Evaporators
- 10 – Vessels
- 11 – Piping
- 12 – Safety Systems
- 13 – Overpressure Protection Devices
- 14 - Purgers
- 15 – Ammonia and Secondary Coolants

Part 3 Appendices

- A – Explanatory Material
- B – Safety Checklists
- C – Water Contamination
- D – Avoiding Abnormal Pressure/Shock
- E – Risk-Based ITM
- F - References

Compliance Schedule [§4.1.3]

- An owner shall be in compliance with this standard when it is adopted by the authority having jurisdiction (AHJ) or when it is adopted by the owner, whichever is first.

Purpose [§1.1]

- This standard specifies minimum requirements for inspection, testing, and maintenance for closed-circuit ammonia refrigeration systems.

Scope [§1.2]

- Record keeping, inspection, testing, and maintenance of closed-circuit ammonia refrigeration systems and ancillary equipment shall comply with this standard. This standard addresses equipment that is common to stationary closed-circuit ammonia refrigeration systems. Due to variations in system design and installation criteria, some systems will not include each type of equipment that this standard addresses.

Responsibility for Compliance [§4.1.1]

- The owner or owner's designated representative shall be responsible for overseeing and ensuring that inspection, testing, and maintenance is performed in accordance with the requirements of this standard.

IIAR 6

Part 1 – General

- 1 – Purpose, Scope, and Applic.
- 2 – Definitions
- 3 – Reference Standards
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Part 2 – Program Requirement

- 5 – General
- 6 – Compressors
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- 12 – Safety Systems
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- 15 – Ammonia and Secondary Coolants

Part 3 Appendices

- A – Explanatory Material
- B – Safety Checklists
- C – Water Contamination
- D – Avoiding Abnormal Pressure/Shock
- E – Risk-Based ITM
- F - References

Type of Purging:

Ammonia Refrigeration Safety Inspection Checklist

PURGERS

Location: _____ ID/Tag No.: _____
Facility Owner: _____
Address: _____
Contact: _____ Phone: _____
Inspector: Date:

Automatic Refrigerated..... ☐
Manual Refrigerated ..... ☐
Manual, Non-Refrigerated ..... ☐

Equipment Data and Limits:

Manufacturer: _____ Model #: _____ Serial #: _____
Year Mfg.: _____ Design Pressure (psig): _____
Operating (psig /°F): _____ / _____ Normal Liquid Level: _____
Total Internal Vol: _____ Cu. Ft. Normal Ammonia Inventory (lbs.): _____
Material: ☐ Carbon Steel, ☐ Stainless Steel, ☐ Aluminum, ☐ Other: _____
Level Indicator Type: ☐ None, ☐ Armored Bullseye, ☐ Level Column w/Bullseye, ☐ Flat Armored, ☐ Level Column Only, ☐ Level Column w/ Veri/Techni Level

Relief Valve Data: ☐ **N/A**

Manufacturer: _____ Model: _____ Year Installed: _____
Assembly: ☐ Dual w/changeover valve ☐ Single Type of Relief Valve: ☐ Internal, ☐ External
Pressure Setting (psig): _____ Capacity (lbs. air per min/SCFM): _____ / _____

Purge Points:

Purge Point: _____ Purge Point: _____
Purge Point: _____ Purge Point: _____
Purge Point: _____ Purge Point: _____
Purge Point: _____ Purge Point: _____
Purge Point: _____ Purge Point: _____
Purge Point: _____ Purge Point: _____
Purge Point: _____ Purge Point: _____
Purge Point: _____ Purge Point: _____

Ammonia Refrigeration Safety Inspection Checklist

AMMONIA ABSORPTION SYSTEM

Location: _____ ID/Tag No.: _____
Facility Owner: _____
Address: _____
Contact: _____ Phone: _____
Inspector: Date:

Equipment Data and Limits:

Manufacturer: _____ Model: _____ Serial Number: _____
Year Mfg.: _____ Listed Certification: _____ Design Temp. (°F): _____
Voltage: _____ Phase: _____ FLA: _____ Design Press. (psig): _____

Absorber Data: (If ASME approved, use the Pressure Vessels Safety Inspection Checklist)

Material of construction: ☐ Steel, ☐ Stainless Steel, ☐ Aluminum, ☐ Other: _____
Absorbent Medium: ☐ Liquid-Vapor, Type Liquid: _____ ☐ Solid-Vapor, Type Solid: _____
Design Temperature (°F): _____ Operating Temperature (°F): _____

Generator (Desorber) Data:

Material of construction: ☐ Steel, ☐ Stainless Steel, ☐ Aluminum, ☐ Other: _____
Generator Heat Source: ☐ Gas, Type: _____, ☐ Electric, ☐ Waste Heat, Fuel Used: _____
Design Temperature (°F): _____ Operating Temperature (°F): _____

Rectifier Data:

Material of construction: ☐ Steel, ☐ Stainless Steel, ☐ Aluminum, ☐ Other: _____

Design Temperature (°F): _____ Operating Temperature (°F): _____

For other Ammonia Absorption System equipment or devices, use all applicable Ammonia Refrigeration System Safety Inspection Checklists such as Condensers, Heat Exchangers, Air-Cooling Evaporators, Pressure Vessels (for absorption vessel), Refrigerant Pumps (ammonia or secondary coolant), Pressure Relief Valves, Ventilation, General Safety, etc.

Are other applicable Ammonia Refrigeration System Safety Inspection Checklists used and attached? Yes ☐ No ☐
If No, explain:

_____
_____
_____
_____
_____

Ammonia Refrigeration Safety Inspection Checklist

SAFETY SYSTEMS

Location: ____________ ID/Tag No.: ____________
Facility Owner: ____________
Address: ____________
Contact: ____________ Phone: ____________
Inspector: ____________ Date: ____________

Ammonia Detector Data: (Use as many copies of this sheet as necessary to document all detectors)

Detector Type: ☐ Catalytic Bead, ☐ Electro-chemical, ☐ Opto-acoustic, ☐ Semi-conductor, ☐ Infrared, ☐ Rupture Disc, ☐ Other: ____________
Manufacturer: ____________ Model: ____________ Alarm Levels (ppm): ____________ Quantity: ______
Location(s): ____________

Detector Type: ☐ Catalytic Bead, ☐ Electro-chemical, ☐ Opto-acoustic, ☐ Semi-conductor, ☐ Infrared, ☐ Rupture Disc, ☐ Other: ____________
Manufacturer: ____________ Model: ____________ Alarm Levels (ppm): ____________ Quantity: ______
Location(s): ____________

Detector Type: ☐ Catalytic Bead, ☐ Electro-chemical, ☐ Opto-acoustic, ☐ Semi-conductor, ☐ Infrared, ☐ Rupture Disc, ☐ Other: ____________
Manufacturer: ____________ Model: ____________ Alarm Levels (ppm): ____________ Quantity: ______
Location(s): ____________

Machinery Room Ventilation System: (Use as many copies of this sheet as necessary to document all exhaust fans)

Continuous Ventilation Fan Data: Quantity: ______
Manufacturer: ____________ Model: ____________ Serial Number(s): ____________
ID/Tag Number(s): ____________ Air Flow (cfm): ____________ Year Mfg.: ____________
Material: ☐ Galv. Steel, ☐ Stainless Steel, ☐ Aluminum Belt Qty: ______ Belt Size: ______

Intermittent (Temperature Control) Ventilation Fan Data: Quantity: ______
Manufacturer: ____________ Model: ____________ Serial Number(s): ____________
ID/Tag Number(s): ____________ Air Flow (cfm): ____________ Year Mfg.: ____________
Material: ☐ Galv. Steel, ☐ Stainless Steel, ☐ Aluminum Belt Qty: ______ Belt Size: ______

Emergency Ventilation Fan Data: Quantity: ______
Manufacturer: ____________ Model: ____________ Serial Number(s): ____________
ID/Tag Number(s): ____________ Air Flow (cfm): ____________ Year Mfg.: ____________
Material: ☐ Galv. Steel, ☐ Stainless Steel, ☐ Aluminum Belt Qty: ______ Belt Size: ______

Ammonia Refrigeration Safety Inspection Checklist

GENERAL SYSTEM

Location: ____________ ID/Tag No.: ____________
Facility Owner: ____________
Address: ____________
Contact: ____________ Phone: ____________
Inspector: ____________ Date: ____________

This checklist applies to the general system components.

Inspection Items	Conforms	Safety Status	Recommended Action, or Comments	Target Date
a) Equipment labeled and nameplate legible per ANSI/IIAR 2?	Yes ☐ No ☐ N/A ☐			
b) All components suitable for ammonia?	Yes ☐ No ☐ N/A ☐			
c) Operating within limits?	Yes ☐ No ☐ N/A ☐			
d) Fasteners tight, adequately anchored, and supported?	Yes ☐ No ☐ N/A ☐			
e) Safe access for Inspection, Testing and Maintenance (ITM)?	Yes ☐ No ☐ N/A ☐			
f) Free of excessive ice buildup?	Yes ☐ No ☐ N/A ☐			
g) Free of abnormal sounds/vibration?				
h) Free of ammonia leaks?	Yes ☐ No ☐ N/A ☐			
i) Adequate protection against traffic hazards?	Yes ☐ No ☐ N/A ☐			
j) Sufficient pressure/temperature gauges and/or transducers are present and functioning adequately?	Yes ☐ No ☐ N/A ☐			
k) Oil pots installed at all points where oil must be drained?	Yes ☐ No ☐ N/A ☐			
l) Oil drain valves are self-closing?	Yes ☐ No ☐ N/A ☐			
m) Sign in machinery room prominently displays: a. Name, address and telephone of installing/servicing contractor? b. Approximate quantity of ammonia? c. Lubricant identity and amount? d. Field test pressure?	Yes ☐ No ☐ N/A ☐			
n) Aisles in machinery room clearly marked and clear of obstructions?	Yes ☐ No ☐ N/A ☐			
o) There is more than one exit from the machinery room?	Yes ☐ No ☐ N/A ☐			
p) At least one exit is designated as a principal machinery room door and has required placarding per IIAR 2? Additional principal machinery room doors and auxiliary machinery room doors have required placarding per IIAR 2?	Yes ☐ No ☐ N/A ☐			

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

AIR-COOLING EVAPORATORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Air Cooling Evaporators

Air Cooling Evaporator Location: _____

Air Cooling Identification Mark/No.: _____

Application

☐ Blast Freezer ☐ Storage Freezer

☐ Process Room ☐ Dock

☐ Storage Cooler

☐ Other *(Describe)*: _____

Type of Refrigerant Feed

☐ Liquid Recirculation ☐ Dry Expansion (DX)

☐ Flooded *(Surge Drum)*

☐ Other *(Describe)*: _____

Application Data

Tube and Fin Material: ☐ carbon steel ☐ stainless steel ☐ aluminum

Defrost Type: ☐ air ☐ water ☐ hot gas ☐ other _____

Design Room Air Temperature *(°F)*: _____ Normal Refrigerant Temperature *(°F)*: _____

Design Capacity *(TR)*: _____ Design Air Flow *(CFM)*: _____

Total Internal Vol. *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Air Cooling Evaporator Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Volts: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

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Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: _____ ID/Tag No.: _____

Facility Owner: _____

Address: _____

Contact: _____ Phone: _____

Inspector: _____ Date: _____

Application: Type of Refrigerant Feed:

Blast Freezer	☐	Liquid Recirculation (Top Feed)	☐
Storage Freezer	☐	Liquid Recirculation (Bottom Feed)	☐
Storage Cooler	☐	Flooded (Surge Drum)	☐
Dock	☐	Direct Expansion (DX)	☐
Process Room	☐	Ammonia Absorption System	☐
Other (Describe)	☐	Other (Describe)	☐

_____ _____

Equipment Data and Limits:

Manufacturer: _____ Model: _____ Serial Number: _____

Year Manufactured: _____ Design Pressure (psig): _____

Room Air Temp (°F): _____ Suction (psig /°F): _____ /

Total Internal Vol: _____ Cu. Ft. Normal Ammonia Inventory (lbs.): _____

Tube and Fin Material: ☐ Galv. Steel, ☐ All Stainless Steel, ☐ Aluminum, ☐ Stainless tube/Aluminum Fin

Defrost Type: ☐ Air, ☐ Water, ☐ Hot Gas, ☐ Other: _____

Fan Motor Data:

Manufacturer: _____ hp: _____ rpm: _____ FLA: _____

Frequency (Hz): _____ Voltage: _____ Phase: _____ Service Factor: _____

Frame Size: _____ Belt Qty: _____ Belt Size: _____ Motor Qty: _____

IIAR Standard 6

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

AIR-COOLING EVAPORATORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Air Cooling Evaporators

Air Cooling Evaporator Location: _____

Air Cooling Identification Mark/No.: _____

Application

☐ Blast Freezer ☐ Storage Freezer

☐ Process Room ☐ Dock

☐ Storage Cooler

☐ Other *(Describe)*: _____

Type of Refrigerant Feed

☐ Liquid Recirculation ☐ Dry Expansion (DX)

☐ Flooded *(Surge Drum)*

☐ Other *(Describe)*: _____

Application Data

Tube and Fin Material: ☐ carbon steel ☐ stainless steel ☐ aluminum

Defrost Type: ☐ air ☐ water ☐ hot gas ☐ other _____

Design Room Air Temperature *(°F)*: _____ Normal Refrigerant Temperature *(°F)*: _____

Design Capacity *(TR)*: _____ Design Air Flow *(CFM)*: _____

Total Internal Vol. *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Air Cooling Evaporator Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Volts: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

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Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: _____ ID/Tag No.: _____

Facility Owner: _____

Address: _____

Contact: _____ Phone: _____

Inspector: _____ Date: _____

Application: Type of Refrigerant Feed:

Blast Freezer	☐	Liquid Recirculation (Top Feed)	☐
Storage Freezer	☐	Liquid Recirculation (Bottom Feed)	☐
Storage Cooler	☐	Flooded (Surge Drum)	☐
Dock	☐	Direct Expansion (DX)	☐
Process Room	☐	Ammonia Absorption System	☐
Other (Describe)	☐	Other (Describe)	☐

_____ _____

Equipment Data and Limits:

Manufacturer: _____ Model: _____ Serial Number: _____

Year Manufactured: _____ Design Pressure (psig): _____

Room Air Temp (°F): _____ Suction (psig /°F): _____ /

Total Internal Vol: _____ Cu. Ft. Normal Ammonia Inventory (lbs.): _____

Tube and Fin Material: ☐ Galv. Steel, ☐ All Stainless Steel, ☐ Aluminum, ☐ Stainless tube/Aluminum Fin

Defrost Type: ☐ Air, ☐ Water, ☐ Hot Gas, ☐ Other: _____

Fan Motor Data:

Manufacturer: _____ hp: _____ rpm: _____ FLA: _____

Frequency (Hz): _____ Voltage: _____ Phase: _____ Service Factor: _____

Frame Size: _____ Belt Qty: _____ Belt Size: _____ Motor Qty: _____

IIAR Standard 6

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

AIR-COOLING EVAPORATORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Air Cooling Evaporators

Air Cooling Evaporator Location: _____

Air Cooling Identification Mark/No.: _____

Application

- ☐ Blast Freezer
- ☐ Storage Freezer
- ☐ Process Room
- ☐ Dock
- ☐ Storage Cooler
- ☐ Other *(Describe)*: _____

Type of Refrigerant Feed

- ☐ Liquid Recirculation
- ☐ Dry Expansion (DX)
- ☐ Flooded *(Surge Drum)*
- ☐ Other *(Describe)*: _____

Application Data

Tube and Fin Material: ☐ carbon steel ☐ stainless steel ☐ aluminum

Defrost Type: ☐ air ☐ water ☐ hot gas ☐ other _____

Design Room Air Temperature *(°F)*: _____ Normal Refrigerant Temperature *(°F)*: _____

Design Capacity *(TR)*: _____ Design Air Flow *(CFM)*: _____

Total Internal Vol. *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Air Cooling Evaporator Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Volts: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

IIAR Bulletin No. 109

Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: _____ ID/Tag No.: _____

Facility Owner: _____

Address: _____

Contact: _____ Phone: _____

Inspector: _____ Date: _____

Application: Type of Refrigerant Feed:

- Blast Freezer ☐
- Storage Freezer ☐
- Storage Cooler ☐
- Dock ☐
- Process Room ☐
- Other (Describe) ☐

- Liquid Recirculation (Top Feed) ☐
- Liquid Recirculation (Bottom Feed) ☐
- Flooded (Surge Drum) ☐
- Direct Expansion (DX) ☐
- Ammonia Absorption System ☐
- Other (Describe) ☐

Equipment Data and Limits:

Manufacturer: _____ Model: _____ Serial Number: _____

Year Manufactured: _____ Design Pressure (psig): _____

Room Air Temp (°F): _____ Suction (psig /°F): _____ /

Total Internal Vol: _____ Cu. Ft. Normal Ammonia Inventory (lbs.): _____

Tube and Fin Material: ☐ Galv. Steel, ☐ All Stainless Steel, ☐ Aluminum, ☐ Stainless tube/Aluminum Fin

Defrost Type: ☐ Air, ☐ Water, ☐ Hot Gas, ☐ Other: _____

Fan Motor Data:

Manufacturer: _____ hp: _____ rpm: _____ FLA: _____

Frequency (Hz): _____ Voltage: _____ Phase: _____ Service Factor: _____

Frame Size: _____ Belt Qty: _____ Belt Size: _____ Motor Qty: _____

IIAR Standard 6

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

AIR-COOLING EVAPORATORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Air Cooling Evaporators

Air Cooling Evaporator Location: _____

Air Cooling Identification Mark/No.: _____

Application

☐ Blast Freezer ☐ Storage Freezer

☐ Process Room ☐ Dock

☐ Storage Cooler

☐ Other *(Describe)*: _____

Type of Refrigerant Feed

☐ Liquid Recirculation ☐ Dry Expansion (DX)

☐ Flooded *(Surge Drum)*

☐ Other *(Describe)*: _____

Application Data

Tube and Fin Material: ☐ carbon steel ☐ stainless steel ☐ aluminum

Defrost Type: ☐ air ☐ water ☐ hot gas ☐ other _____

Design Room Air Temperature *(°F)*: _____ Normal Refrigerant Temperature *(°F)*: _____

Design Capacity *(TR)*: _____ Design Air Flow *(CFM)*: _____

Total Internal Vol. *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Air Cooling Evaporator Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Volts: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

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Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: _____ ID/Tag No.: _____

Facility Owner: _____

Address: _____

Contact: _____ Phone: _____

Inspector: _____ Date: _____

Application: Type of Refrigerant Feed:

Blast Freezer ☐ Liquid Recirculation (Top Feed) ☐

Storage Freezer ☐ Liquid Recirculation (Bottom Feed) ☐

Storage Cooler ☐ Flooded (Surge Drum) ☐

Dock ☐ Direct Expansion (DX) ☐

Process Room ☐ Ammonia Absorption System ☐

Other (Describe) ☐ Other (Describe) ☐

_____ _____

Equipment Data and Limits:

Manufacturer: _____ Model: _____ Serial Number: _____

Year Manufactured: _____ Design Pressure (psig): _____

Room Air Temp (°F): _____ Suction (psig /°F): _____ /

Total Internal Vol: _____ Cu. Ft. Normal Ammonia Inventory (lbs.): _____

Tube and Fin Material: ☐ Galv. Steel, ☐ All Stainless Steel, ☐ Aluminum, ☐ Stainless tube/Aluminum Fin

Defrost Type: ☐ Air, ☐ Water, ☐ Hot Gas, ☐ Other: _____

Fan Motor Data:

Manufacturer: _____ hp: _____ rpm: _____ FLA: _____

Frequency (Hz): _____ Voltage: _____ Phase: _____ Service Factor: _____

Frame Size: _____ Belt Qty: _____ Belt Size: _____ Motor Qty: _____

IIAR Standard 6

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

AIR-COOLING EVAPORATORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Air Cooling Evaporators

Air Cooling Evaporator Location: _____

Air Cooling Identification Mark/No.: _____

Application

☐ Blast Freezer ☐ Storage Freezer

☐ Process Room ☐ Dock

☐ Storage Cooler

☐ Other *(Describe)*: _____

Type of Refrigerant Feed

☐ Liquid Recirculation ☐ Dry Expansion (DX)

☐ Flooded *(Surge Drum)*

☐ Other *(Describe)*: _____

Application Data

Tube and Fin Material: ☐ carbon steel ☐ stainless steel ☐ aluminum

Defrost Type: ☐ air ☐ water ☐ hot gas ☐ other _____

Design Room Air Temperature *(°F)*: _____ Normal Refrigerant Temperature *(°F)*: _____

Design Capacity *(TR)*: _____ Design Air Flow *(CFM)*: _____

Total Internal Vol. *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Air Cooling Evaporator Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Volts: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

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Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: _____ ID/Tag No.: _____

Facility Owner: _____

Address: _____

Contact: _____ Phone: _____

Inspector: _____ Date: _____

Application: Type of Refrigerant Feed:

Blast Freezer	☐	Liquid Recirculation (Top Feed)	☐
Storage Freezer	☐	Liquid Recirculation (Bottom Feed)	☐
Storage Cooler	☐	Flooded (Surge Drum)	☐
Dock	☐	Direct Expansion (DX)	☐
Process Room	☐	Ammonia Absorption System	☐
Other (Describe)	☐	Other (Describe)	☐

_____ _____

Equipment Data and Limits:

Manufacturer: _____ Model: _____ Serial Number: _____

Year Manufactured: _____ Design Pressure (psig): _____

Room Air Temp (°F): _____ Suction (psig /°F): _____ /

Total Internal Vol: _____ Cu. Ft. Normal Ammonia Inventory (lbs.): _____

Tube and Fin Material: ☐ Galv. Steel, ☐ All Stainless Steel, ☐ Aluminum, ☐ Stainless tube/Aluminum Fin

Defrost Type: ☐ Air, ☐ Water, ☐ Hot Gas, ☐ Other: _____

Fan Motor Data:

Manufacturer: _____ hp: _____ rpm: _____ FLA: _____

Frequency (Hz): _____ Voltage: _____ Phase: _____ Service Factor: _____

Frame Size: _____ Belt Qty: _____ Belt Size: _____ Motor Qty: _____

IIAR Standard 6

International Institute of Ammonia Refrigeration

Ammonia Refrigeration Safety Inspection Checklist

ID Number: _____

AIR-COOLING EVAPORATORS

Plant Owner: _____

Address: _____

Contact: _____ Telephone: _____

Inspector: _____ Date: _____

Air Cooling Evaporators

Air Cooling Evaporator Location: _____

Air Cooling Identification Mark/No.: _____

Application

☐ Blast Freezer ☐ Storage Freezer

☐ Process Room ☐ Dock

☐ Storage Cooler

☐ Other *(Describe)*: _____

Type of Refrigerant Feed

☐ Liquid Recirculation ☐ Dry Expansion (DX)

☐ Flooded *(Surge Drum)*

☐ Other *(Describe)*: _____

Application Data

Tube and Fin Material: ☐ carbon steel ☐ stainless steel ☐ aluminum

Defrost Type: ☐ air ☐ water ☐ hot gas ☐ other _____

Design Room Air Temperature *(°F)*: _____ Normal Refrigerant Temperature *(°F)*: _____

Design Capacity *(TR)*: _____ Design Air Flow *(CFM)*: _____

Total Internal Vol. *(cubic ft)*: _____

Normal Ammonia Inventory *(Volume/Weight)*: ☐ cubic ft: _____ ☐ lb: _____

Air Cooling Evaporator Nameplate Data

Manufacturer, Name, Model, Serial No.: _____

Year Manufactured: _____ Design Pressure *(psig)*: _____

Fan Motor Nameplate Data

Manufacturer, Name, Model, Serial No., Year Manufactured: _____

Frame Size: _____ Type: _____ Speed *(rpm)*: _____ Power *(hp)*: _____

Volts: _____ FLA *(amps)*: _____ Phase: ☐ 1 ☐ 3

Frequency *(Hz)*: _____ Belt size and number: _____

IIAR Bulletin No. 109

Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: _____ ID/Tag No.: _____

Facility Owner: _____

Address: _____

Contact: _____ Phone: _____

Inspector: _____ Date: _____

Application: Type of Refrigerant Feed:

Blast Freezer	☐	Liquid Recirculation (Top Feed)	☐
Storage Freezer	☐	Liquid Recirculation (Bottom Feed)	☐
Storage Cooler	☐	Flooded (Surge Drum)	☐
Dock	☐	Direct Expansion (DX)	☐
Process Room	☐	Ammonia Absorption System	☐
Other (Describe)	☐	Other (Describe)	☐

_____ _____

Equipment Data and Limits:

Manufacturer: _____ Model: _____ Serial Number: _____

Year Manufactured: _____ Design Pressure (psig): _____

Room Air Temp (°F): _____ Suction (psig /°F): _____ /

Total Internal Vol: _____ Cu. Ft. Normal Ammonia Inventory (lbs.): _____

Tube and Fin Material: ☐ Galv. Steel, ☐ All Stainless Steel, ☐ Aluminum, ☐ Stainless tube/Aluminum Fin

Defrost Type: ☐ Air, ☐ Water, ☐ Hot Gas, ☐ Other: _____

Fan Motor Data:

Manufacturer: _____ hp: _____ rpm: _____ FLA: _____

Frequency (Hz): _____ Voltage: _____ Phase: _____ Service Factor: _____

Frame Size: _____ Belt Qty: _____ Belt Size: _____ Motor Qty: _____

IIAR Standard 6

ID Number: _____

AIR-COOLING EVAPORATORS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible & complete?	☐ Yes ☐ No			
b) Suitable for ammonia?	☐ Yes ☐ No			
c) Operation within limits?	☐ Yes ☐ No			
d) Adequately anchored and supported?	☐ Yes ☐ No			
e) Safe access for service & maintenance?	☐ Yes ☐ No			
f) Free from excessive vibration?	☐ Yes ☐ No			
g) Adequate protection against traffic hazards?	☐ Yes ☐ No			
h) Evaporator free from excessive ice buildup and clean of dirt?	☐ Yes ☐ No			
i) Drive properly guarded & protected?	☐ Yes ☐ No			
j) Evaporator condition (check one)	☐ clean, no visible corrosion ☐ slight visible corrosion ☐ extensive corrosion			

Are there any other conditions that might negatively affect safe evaporator operation? ☐ Yes ☐ No

If yes, describe. _____

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Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: ID/Tag No.:

Inspection Items	Conforms	Safety Status	Recommended Action, or Comments	Target Date
a) Equipment labeled and nameplate legible per ANSI/IIAR 2?	Yes ☐ No ☐ N/A ☐			
b) Suitable for ammonia?	Yes ☐ No ☐ N/A ☐			
c) Operating within limits?	Yes ☐ No ☐ N/A ☐			
d) Fasteners tight, adequately anchored, and supported?	Yes ☐ No ☐ N/A ☐			
e) Safe access for Inspection, Testing and Maintenance (ITM)?	Yes ☐ No ☐ N/A ☐			
f) Free of excessive ice buildup?	Yes ☐ No ☐ N/A ☐			
g) Free of abnormal sounds/vibration?	Yes ☐ No ☐ N/A ☐			
h) Free of ammonia leaks?	Yes ☐ No ☐ N/A ☐			
i) All piping has markers per ANSI/IIAR 2?	Yes ☐ No ☐ N/A ☐			
j) Are valves in good condition?	Yes ☐ No ☐ N/A ☐			
k) Are critical manual and control valves tagged, exercised, and stems lubricated?	Yes ☐ No ☐ N/A ☐			
l) Sufficient pressure/temperature gauges and/or transducers are present and functioning adequately?	Yes ☐ No ☐ N/A ☐			
m) Belts, sheaves, coupling, etc., in good working order and adequately guarded?	Yes ☐ No ☐ N/A ☐			
n) Free of pitting and surface damage and coils free of dirt? a. If No, note damage level:	Yes ☐ No ☐ N/A ☐ Slight ☐ Extensive ☐			
o) Free of any other conditions that negatively affect safe operation?	Yes ☐ No ☐ N/A ☐			

If No, describe:

IIAR Standard 6

ID Number: _____

AIR-COOLING EVAPORATORS

Requirement/Recommendation	Conforms	Recommended Action/Comments	Safety Status	Target Date
a) Nameplate legible & complete?	☐ Yes ☐ No			
b) Suitable for ammonia?	☐ Yes ☐ No			
c) Operation within limits?	☐ Yes ☐ No			
d) Adequately anchored and supported?	☐ Yes ☐ No			
e) Safe access for service & maintenance?	☐ Yes ☐ No			
f) Free from excessive vibration?	☐ Yes ☐ No			
g) Adequate protection against traffic hazards?	☐ Yes ☐ No			
h) Evaporator free from excessive ice buildup and clean of dirt?	☐ Yes ☐ No			
i) Drive properly guarded & protected?	☐ Yes ☐ No			

j) Evaporator condition (check one) ☐ clean, no visible corrosion ☐ slight visible corrosion ☐ extensive corrosion

Are there any other conditions that might negatively affect safe evaporator operation? ☐ Yes ☐ No

If yes, describe. _____

IIAR Bulletin No. 109

Ammonia Refrigeration Safety Inspection Checklist

AIR-COOLING EVAPORATOR

Location: ID/Tag No.:

Inspection Items	Conforms	Safety Status	Recommended Action, or Comments	Target Date
a) Equipment labeled and nameplate legible per ANSI/IIAR 2?	Yes ☐ No ☐ N/A ☐			
b) Suitable for ammonia?	Yes ☐ No ☐ N/A ☐			
c) Operating within limits?	Yes ☐ No ☐ N/A ☐			
d) Fasteners tight, adequately anchored, and supported?	Yes ☐ No ☐ N/A ☐			
e) Safe access for Inspection, Testing and Maintenance (ITM)?	Yes ☐ No ☐ N/A ☐			
f) Free of excessive ice buildup?	Yes ☐ No ☐ N/A ☐			
g) Free of abnormal sounds/vibration?	Yes ☐ No ☐ N/A ☐			
h) Free of ammonia leaks?	Yes ☐ No ☐ N/A ☐			
i) All piping has markers per ANSI/IIAR 2?	Yes ☐ No ☐ N/A ☐			
j) Are valves in good condition?	Yes ☐ No ☐ N/A ☐			
k) Are critical manual and control valves tagged, exercised, and stems lubricated?	Yes ☐ No ☐ N/A ☐			
l) Sufficient pressure/temperature gauges and/or transducers are present and functioning adequately?	Yes ☐ No ☐ N/A ☐			
m) Belts, sheaves, coupling, etc., in good working order and adequately guarded?	Yes ☐ No ☐ N/A ☐			
n) Free of pitting and surface damage and coils free of dirt? a. If No, note damage level:	Yes ☐ No ☐ N/A ☐ Slight ☐ Extensive ☐			
o) Free of any other conditions that negatively affect safe operation?	Yes ☐ No ☐ N/A ☐			

If No, describe:

IIAR Standard 6

	and Maintenance (ITM)?				
	f) Free of excessive ice buildup?	Yes ☐ No ☐ N/A ☐			
	g) Free of abnormal sounds/vibration?	Yes ☐ No ☐ N/A ☐			
→	h) Free of ammonia leaks?	Yes ☐ No ☐ N/A ☐			
→	i) All piping has markers per ANSI/IIAR 2?	Yes ☐ No ☐ N/A ☐			
→	j) Are valves in good condition?	Yes ☐ No ☐ N/A ☐			
→	k) Are critical manual and control valves tagged, exercised, and stems lubricated?	Yes ☐ No ☐ N/A ☐			
→	l) Sufficient pressure/temperature gauges and/or transducers are present and functioning adequately?	Yes ☐ No ☐ N/A ☐			
	m) Belts, sheaves, coupling, etc., in good working order and adequately	Yes ☐ No ☐ N/A ☐			


IIAR 6
PSM Mechanical Integrity Requirements

ANSI/IIAR 6-2019 §5.1	*The owner or owner's designated representative shall ensure an inspection, testing, and maintenance program is developed to reduce the probability of an ammonia release.*
Title 8 §5189(j)(1)(A)	*The employer shall establish and implement written procedures to maintain the ongoing integrity of process equipment and appurtenances.*

IIAR 6	Title 8 §5189(j)(2)D)
Date of the inspection or test	Date of Inspection
Name of the individual or individuals who performed the inspection or test	Name of person who performed inspection or test
Serial number or other identifier of the equipment on which the inspection or test was performed	Serial number or other identifier
Description of the inspection or test performed	
Recommended corrective action(s) for each deficiency identified	
Description of corrective action(s) for each deficiency identified	
Identification of each designated responsible person assigned and authorized to remedy each deficiency identified	
Results based on the conditions at commencement of the inspection or test, including instrumentation readings	
Expected activation set points (+/-) including a functional description of the control logic	
Results based on the conditions after completion of the inspection or test, including instrumentation readings	
Expected completion date(s)	
Actual completion date(s)	


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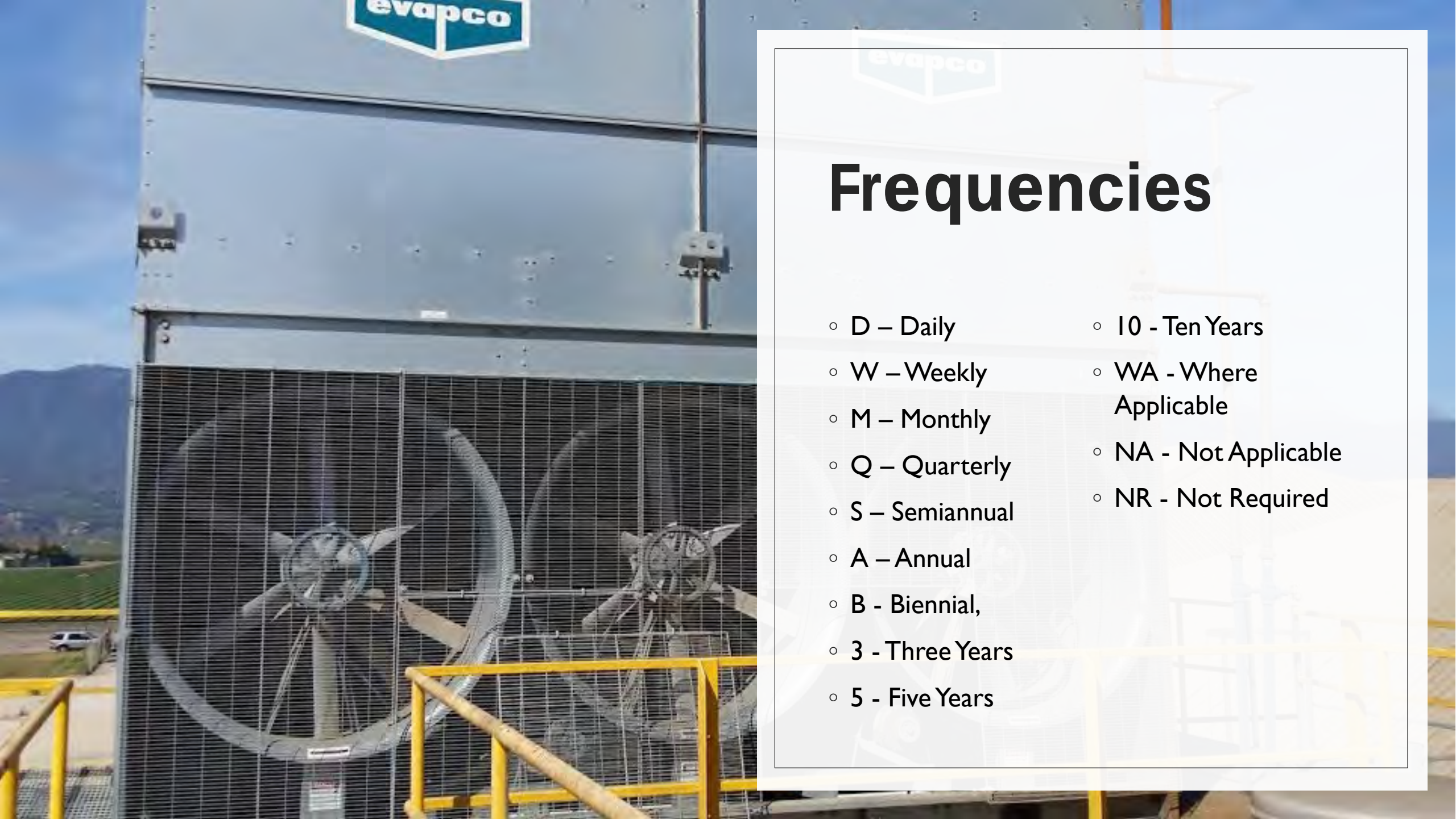
freitag

Period	Calendar Basis	Runtime Basis (hours)
Daily	Occurring once per 24 hours.	24
Weekly	Occurring once per calendar week.	168
Monthly	Occurring once per calendar month.	730
Quarterly	Occurring four times per year. The minimum period between ITM tasks is 2 months. The maximum is 4 months.	2,190
Semiannual	Occurring twice per 12 consecutive months. The minimum period between ITM tasks is 4 months. The maximum is 8 months.	4,380
Annual	Occurring once per year. The minimum period between ITM tasks is 9 months. The maximum is 15 months.	8,760
Biennial (Two Years)	Occurring once every other year. The minimum period between ITM tasks is 21 months. The maximum is 27 months.	17,520
Three Years	Occurring once every 36 months. The minimum period between ITM tasks is 30 months. The maximum is 42 months.	26,280
Five Years	Occurring once every 60 months. The minimum period between ITM tasks is 54 months. The maximum is 66 months.	43,800
Ten Years	Occurring once every 120 months. The minimum period between ITM tasks is 108 months. The maximum is 132 months.	87,600

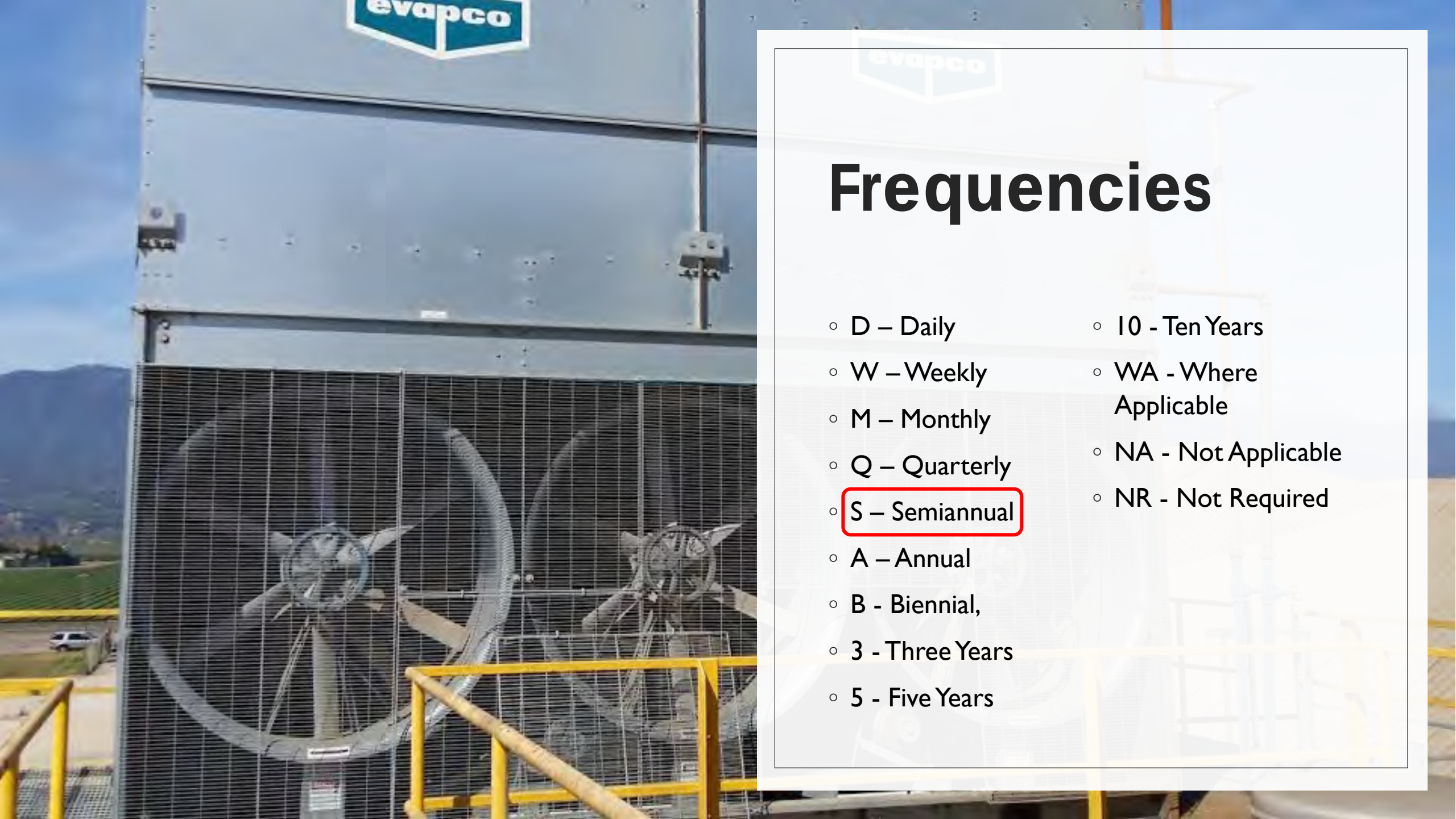
Period	Calendar Basis	Runtime Basis (hours)
Daily	Occurring once per 24 hours.	24
Weekly	Occurring once per calendar week.	168
Monthly	Occurring once per calendar month.	730
Quarterly	Occurring four times per year. The minimum period between ITM tasks is 2 months. The maximum is 4 months.	2,190
Semiannual	Occurring twice per 12 consecutive months. The minimum period between ITM tasks is 4 months. The maximum is 8 months.	4,380
Annual	Occurring once per year. The minimum period between ITM tasks is 9 months. The maximum is 15 months.	8,760
Biennial (Two Years)	Occurring once every other year. The minimum period between ITM tasks is 21 months. The maximum is 27 months.	17,520
Three Years	Occurring once every 36 months. The minimum period between ITM tasks is 30 months. The maximum is 42 months.	26,280
Five Years	Occurring once every 60 months. The minimum period between ITM tasks is 54 months. The maximum is 66 months.	43,800
Ten Years	Occurring once every 120 months. The minimum period between ITM tasks is 108 months. The maximum is 132 months.	87,600

Period	Calendar Basis	Runtime Basis (hours)
Daily	Occurring once per 24 hours.	24
Weekly	Occurring once per calendar week.	168
Monthly	Occurring once per calendar month.	730
Quarterly	Occurring four times per year. The minimum period between ITM tasks is 2 months. The maximum is 4 months.	2,190
Semiannual	Occurring twice per 12 consecutive months. The minimum period between ITM tasks is 4 months. The maximum is 8 months.	4,380
Annual	Occurring once per year. The minimum period between ITM tasks is 9 months. The maximum is 15 months.	8,760
Biennial (Two Years)	Occurring once every other year. The minimum period between ITM tasks is 21 months. The maximum is 27 months.	17,520
Three Years	Occurring once every 36 months. The minimum period between ITM tasks is 30 months. The maximum is 42 months.	26,280
Five Years	Occurring once every 60 months. The minimum period between ITM tasks is 54 months. The maximum is 66 months.	43,800
Ten Years	Occurring once every 120 months. The minimum period between ITM tasks is 108 months. The maximum is 132 months.	87,600



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



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

ITM Task Description	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
a) Runtime hours	WA-D	WA-D	WA-D
b) Suction pressure	D	D	D
c) Discharge pressure	D	D	D
d) Oil pressure	D	D	D
e) Oil temperature	D	WA-D	D
f) Discharge temperature	D	WA-D	D
g) Verify oil levels are adequate	D	D	D
h) Oil filter differential pressure	D	WA-D	NA
i) Oil leaks	D	D	D
j) Lubricator oil level and drip rate	NA	NA	D
k) Jacket cooling oil level	NA	NA	D
l) Determine shaft seal leak rate	WA-W	WA-W	WA-W
m) Indicator of Compressor Capacity	D	WA-D	WA-D
n) Motor amperage (current)	D	WA-D	WA-D
o) Recorded Alarms and Shutdowns	D	WA-D	WA-D
p) Free from abnormal sounds and excessive vibration	D	D	D

ITM Task	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
q) Drive guard in place	D	D	D
r) Foundation solid, in place, and free from evidence of deterioration	A	A	A
s) Visually inspect mounting bolts are in place	A	A	A
t) Visually inspect metal surfaces for pitting or surface damage	A	A	A
u) Visually inspect coupling for wear	A	WA-A	WA-A
v) Visually inspect starter connections and associated timers and relays	A	A	A
w) Operation of oil heaters	A	A	A
x) Operation of unloader	M	M	M
y) Visually inspect alignment of compressor-motor drive shaft	A	A	A
Testing	**Screw**	**Recip**	**Rotary Vane**
Test safety shutdowns:			
a) Low suction pressure cutout	A	A	A
b) High discharge pressure cutout (HPCO) See Section 6.1.1	A	A	A

ITM Task Description	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
a) Runtime hours	WA-D	WA-D	WA-D
b) Suction pressure	D	D	D
c) Discharge pressure	D	D	D
d) Oil pressure	D	D	D
e) Oil temperature	D	WA-D	D
f) Discharge temperature	D	WA-D	D
g) Verify oil levels are adequate	D	D	D
h) Oil filter differential pressure	D	WA-D	NA
i) Oil leaks	D	D	D
j) Lubricator oil level and drip rate	NA	NA	D
k) Jacket cooling oil level	NA	NA	D
l) Determine shaft seal leak rate	WA-W	WA-W	WA-W
m) Indicator of Compressor Capacity	D	WA-D	WA-D
n) Motor amperage (current)	D	WA-D	WA-D
o) Recorded Alarms and Shutdowns	D	WA-D	WA-D
p) Free from abnormal sounds and excessive vibration	D	D	D

ITM Task	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
q) Drive guard in place	D	D	D
r) Foundation solid, in place, and free from evidence of deterioration	A	A	A
s) Visually inspect mounting bolts are in place	A	A	A
t) Visually inspect metal surfaces for pitting or surface damage	A	A	A
u) Visually inspect coupling for wear	A	WA-A	WA-A
v) Visually inspect starter connections and associated timers and relays	A	A	A
w) Operation of oil heaters	A	A	A
x) Operation of unloader	M	M	M
y) Visually inspect alignment of compressor-motor drive shaft	A	A	A
Testing	**Screw**	**Recip**	**Rotary Vane**
Test safety shutdowns:			
a) Low suction pressure cutout	A	A	A
b) High discharge pressure cutout (HPCO) See Section 6.1.1	A	A	A

ITM Task Description	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
a) Runtime hours	WA-D	WA-D	WA-D
b) Suction pressure	D	D	D
c) Discharge pressure	D	D	D
d) Oil pressure	D	D	D
e) Oil temperature	D	WA-D	D
f) Discharge temperature	D	WA-D	D
g) Verify oil levels are adequate	D	D	D
h) Oil filter differential pressure	D	WA-D	NA
i) Oil leaks	D	D	D
j) Lubricator oil level and drip rate	NA	NA	D
k) Jacket cooling oil level	NA	NA	D
l) Determine shaft seal leak rate	WA-W	WA-W	WA-W
m) Indicator of Compressor Capacity	D	WA-D	WA-D
n) Motor amperage (current)	D	WA-D	WA-D
o) Recorded Alarms and Shutdowns	D	WA-D	WA-D
p) Free from abnormal sounds and excessive vibration	D	D	D

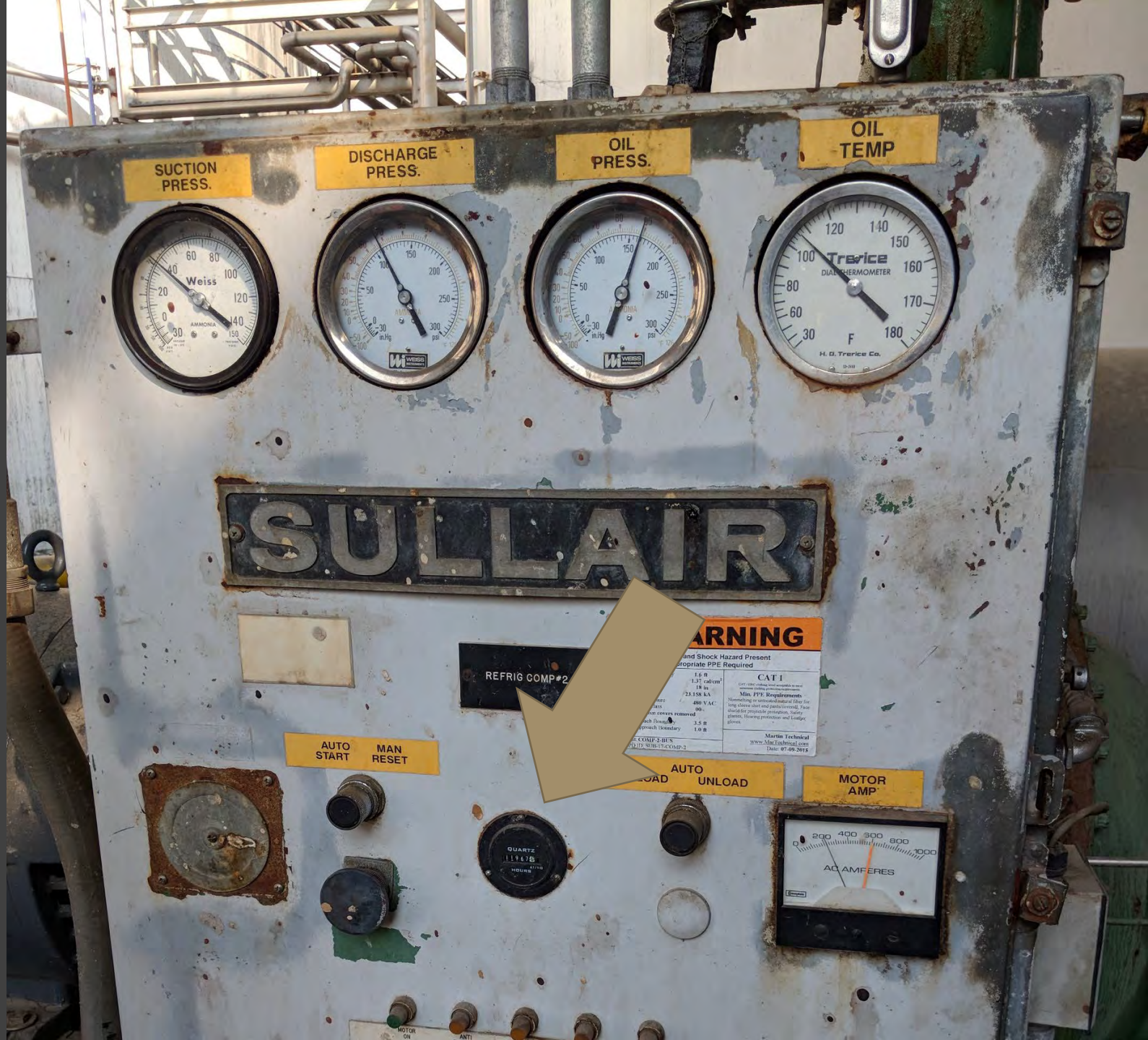
ITM Task	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
q) Drive guard in place	D	D	D
r) Foundation solid, in place, and free from evidence of deterioration	A	A	A
s) Visually inspect mounting bolts are in place	A	A	A
t) Visually inspect metal surfaces for pitting or surface damage	A	A	A
u) Visually inspect coupling for wear	A	WA-A	WA-A
v) Visually inspect starter connections and associated timers and relays	A	A	A
w) Operation of oil heaters	A	A	A
x) Operation of unloader	M	M	M
y) Visually inspect alignment of compressor-motor drive shaft	A	A	A
Testing	**Screw**	**Recip**	**Rotary Vane**
Test safety shutdowns:			
a) Low suction pressure cutout	A	A	A
b) High discharge pressure cutout (HPCO) See Section 6.1.1	A	A	A

ITM Task Description	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
a) Runtime hours	WA-D	WA-D	WA-D
b) Suction pressure	D	D	D
c) Discharge pressure	D	D	D
d) Oil pressure	D	D	D
e) Oil temperature	D	WA-D	D
f) Discharge temperature	D	WA-D	D
g) Verify oil levels are adequate	D	D	D
h) Oil filter differential pressure	D	WA-D	NA
i) Oil leaks	D	D	D
j) Lubricator oil level and drip rate	NA	NA	D
k) Jacket cooling oil level	NA	NA	D
l) Determine shaft seal leak rate	WA-W	WA-W	WA-W
m) Indicator of Compressor Capacity	D	WA-D	WA-D
n) Motor amperage (current)	D	WA-D	WA-D
o) Recorded Alarms and Shutdowns	D	WA-D	WA-D
p) Free from abnormal sounds and excessive vibration	D	D	D

ITM Task	Frequency		
Inspection	**Screw**	**Recip**	**Rotary Vane**
q) Drive guard in place	D	D	D
r) Foundation solid, in place, and free from evidence of deterioration	A	A	A
s) Visually inspect mounting bolts are in place	A	A	A
t) Visually inspect metal surfaces for pitting or surface damage	A	A	A
u) Visually inspect coupling for wear	A	WA-A	WA-A
v) Visually inspect starter connections and associated timers and relays	A	A	A
w) Operation of oil heaters	A	A	A
x) Operation of unloader	M	M	M
y) Visually inspect alignment of compressor-motor drive shaft	A	A	A
Testing	**Screw**	**Recip**	**Rotary Vane**
Test safety shutdowns:			
a) Low suction pressure cutout	A	A	A
b) High discharge pressure cutout (HPCO) See Section 6.1.1	A	A	A

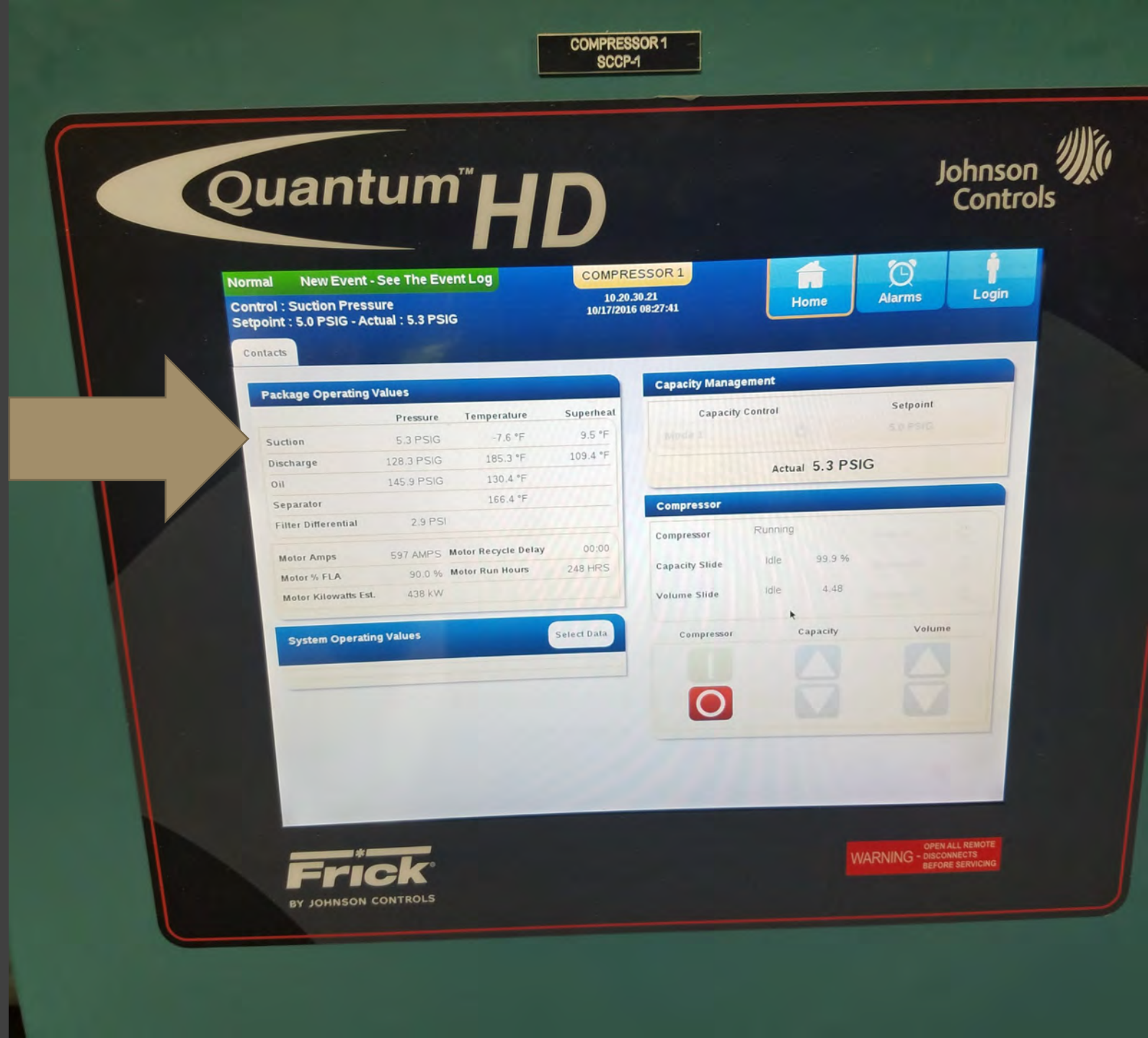
DAILY INSPECTIONS

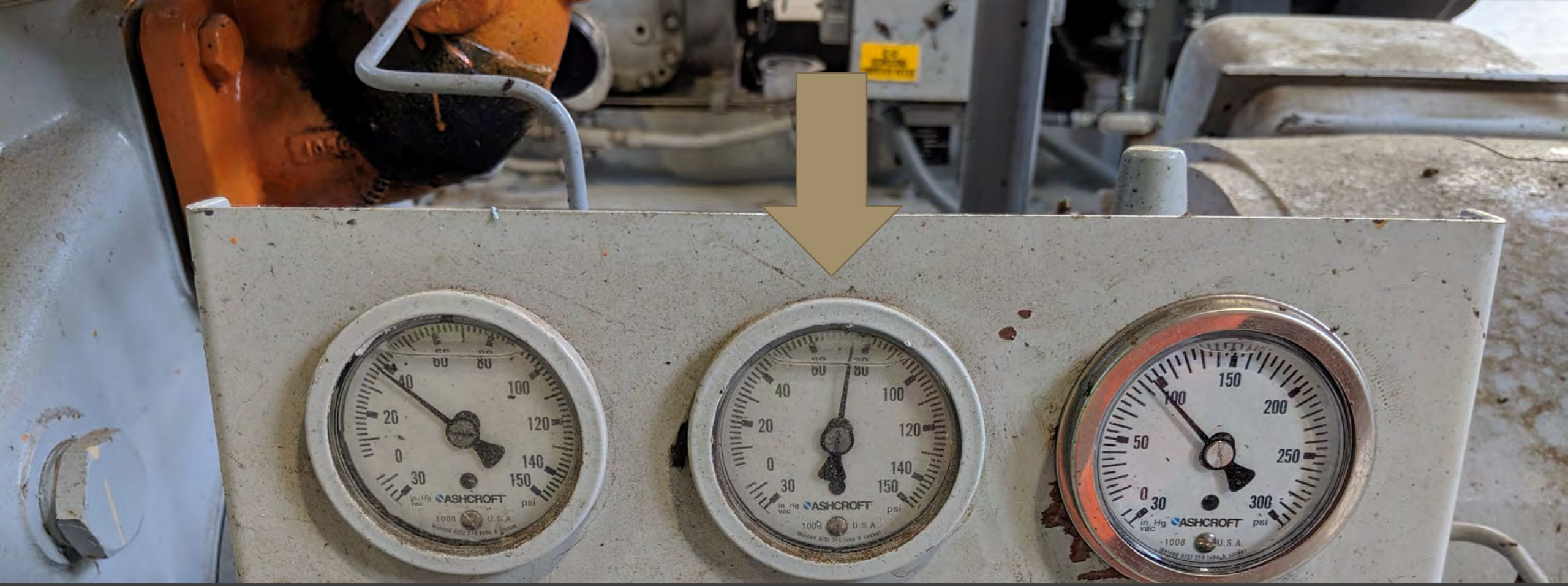
Record compressor runtime (hours)



DAILY INSPECTIONS

Record compressor suction pressure



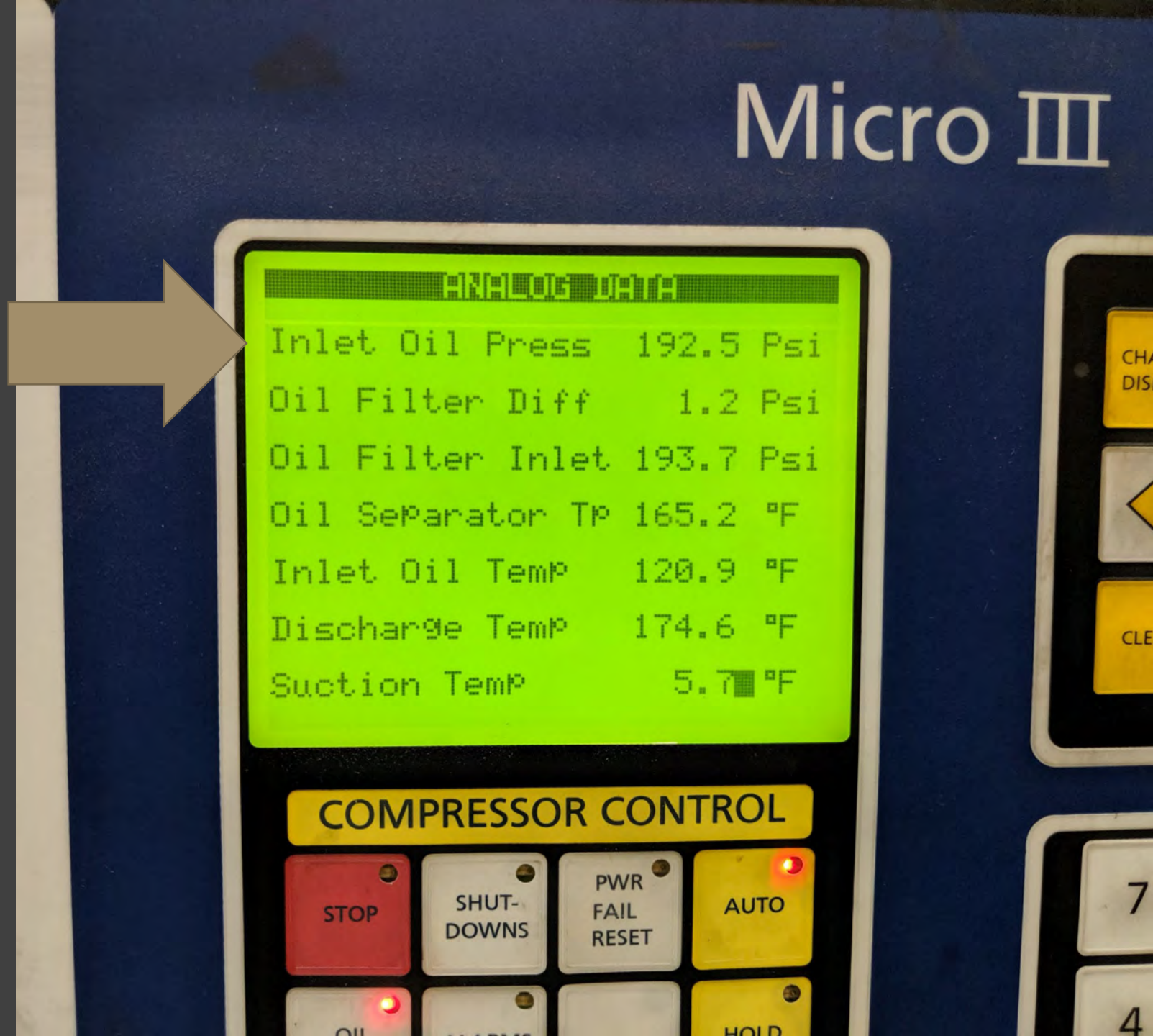


DAILY INSPECTIONS

Record compressor discharge pressure

DAILY INSPECTIONS

Record compressor oil pressure

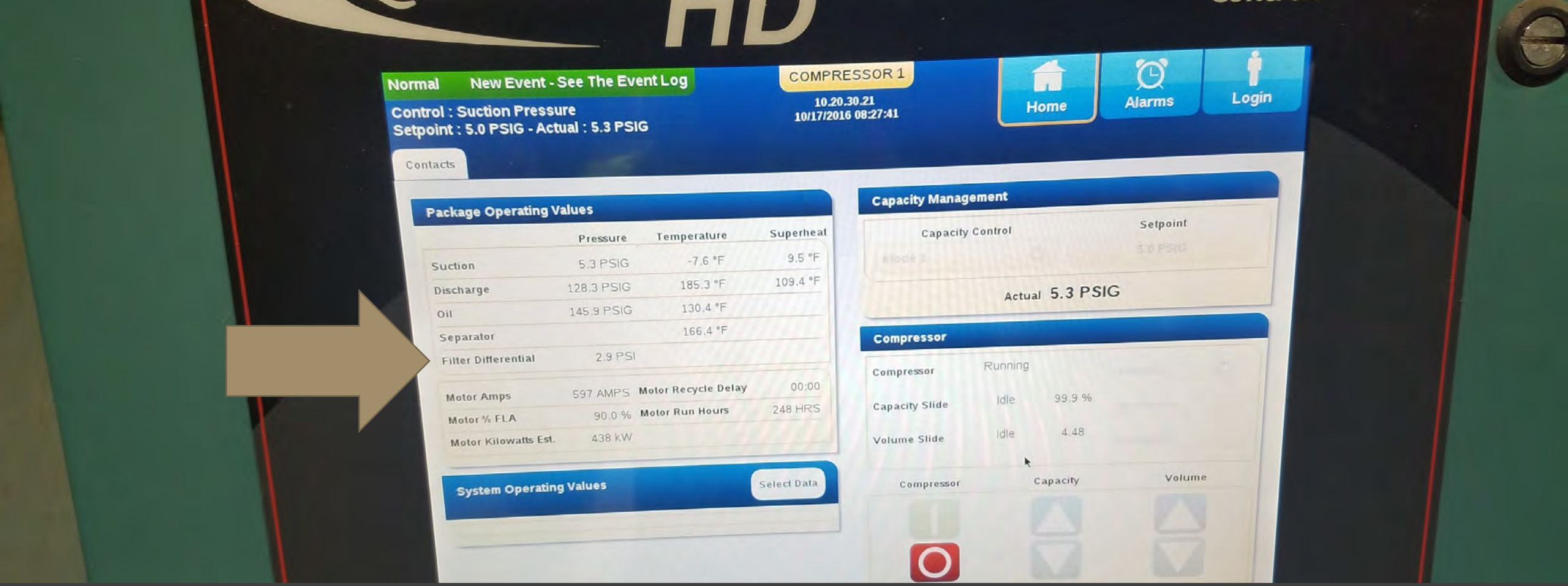


DAILY INSPECTIONS

Record compressor oil temperature

DAILY INSPECTIONS

Record compressor discharge temperature

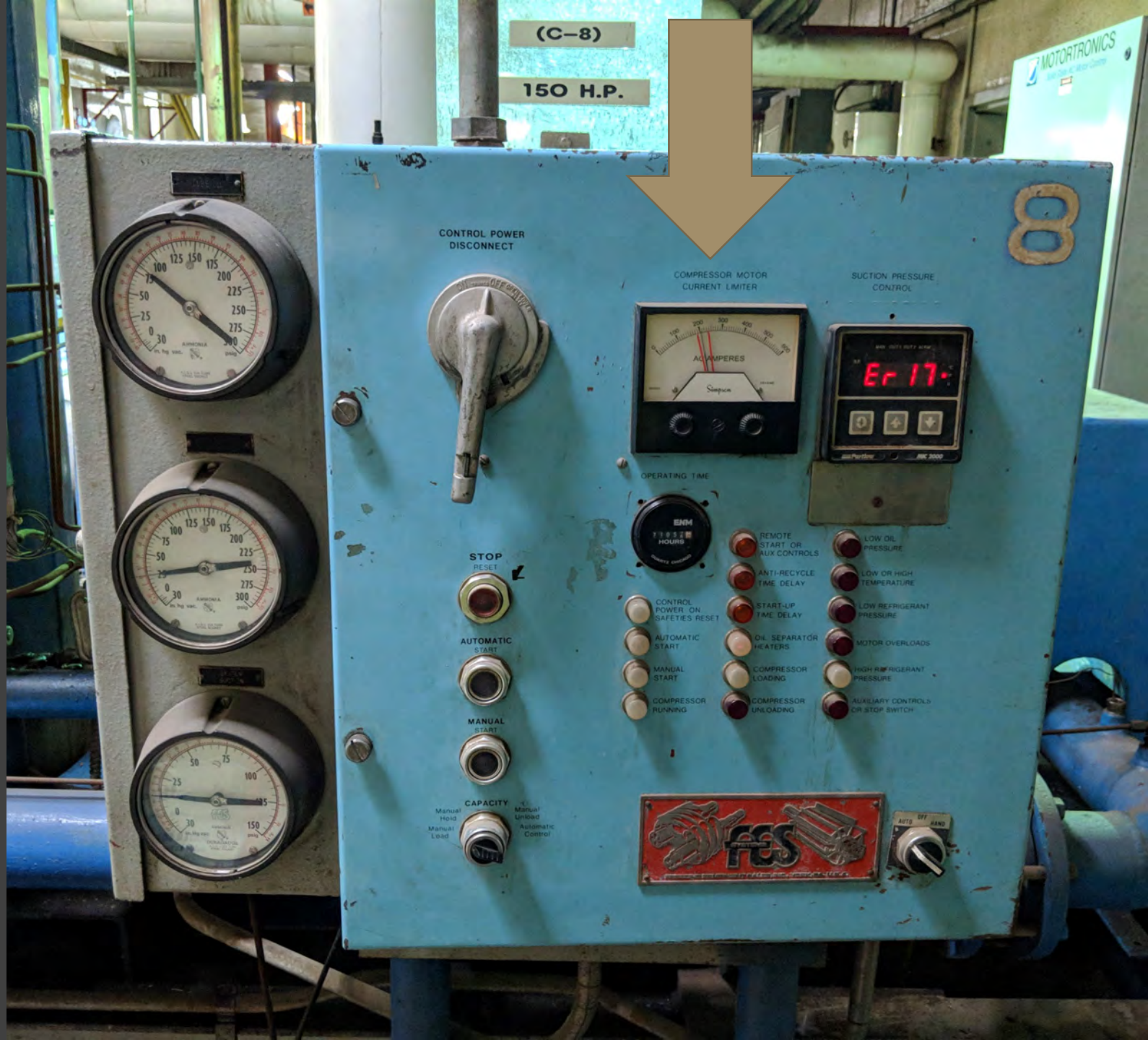


DAILY INSPECTIONS

Record compressor oil filter differential pressure

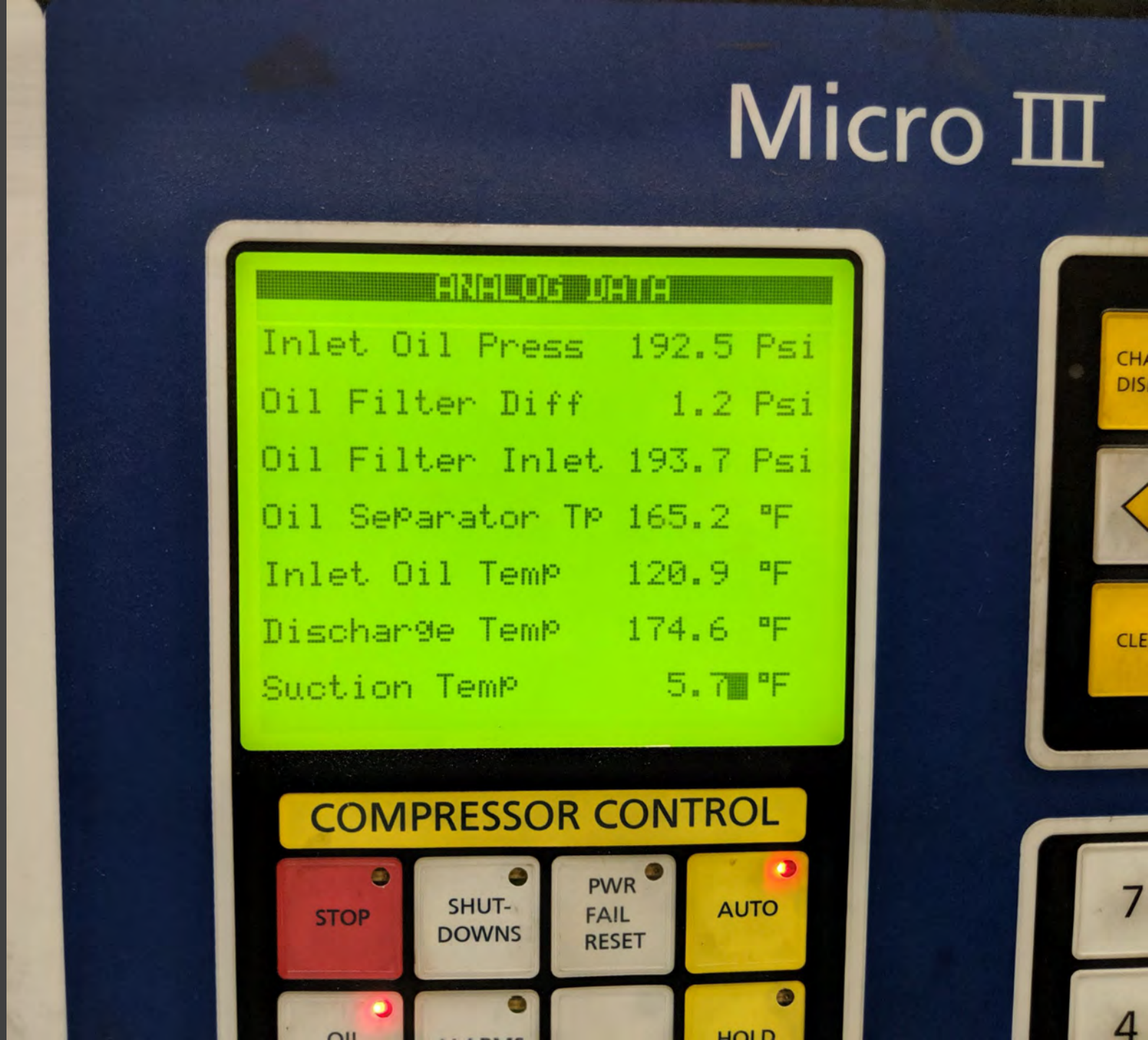
DAILY INSPECTIONS

Record compressor motor amperage



DAILY INSPECTIONS

Record compressor alarms and shutdowns

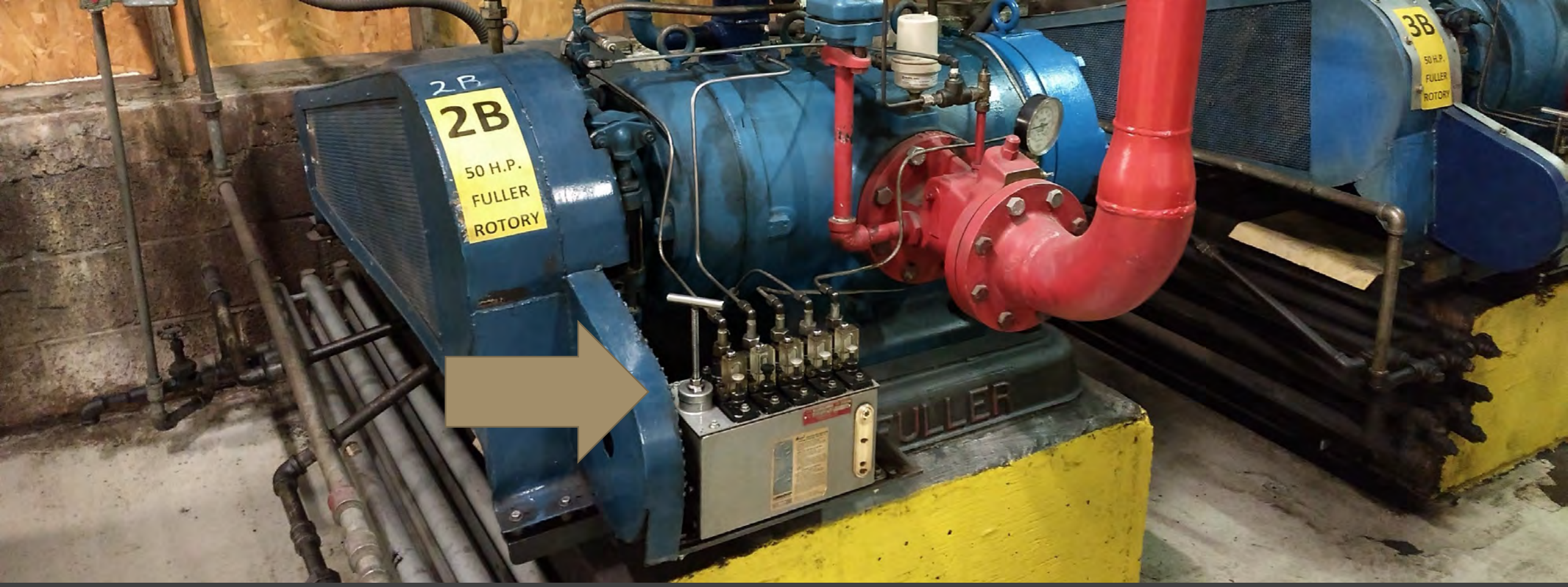


DAILY INSPECTIONS

Verify oil levels are adequate

DAILY INSPECTIONS

Check for oil leaks



DAILY INSPECTIONS

Check lubricator oil level and drip rate

DAILY INSPECTIONS

Check compressor for unusual vibration

WEEKLY INSPECTIONS

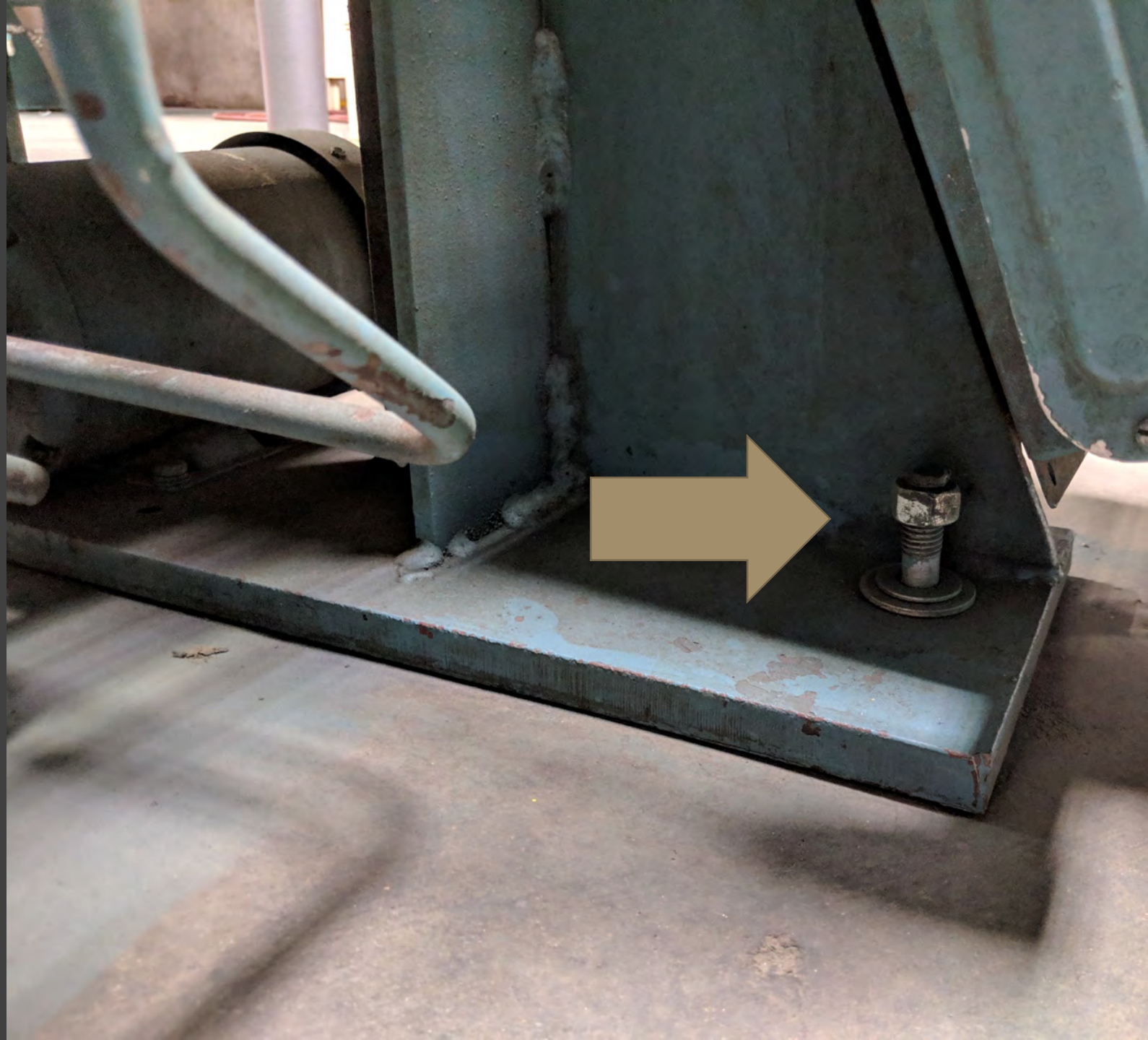
Check shaft seal drip rate

ANNUAL INSPECTIONS

Check that foundation is solid

ANNUAL INSPECTIONS

Check mounting bolts for tightness



ANNUAL INSPECTIONS

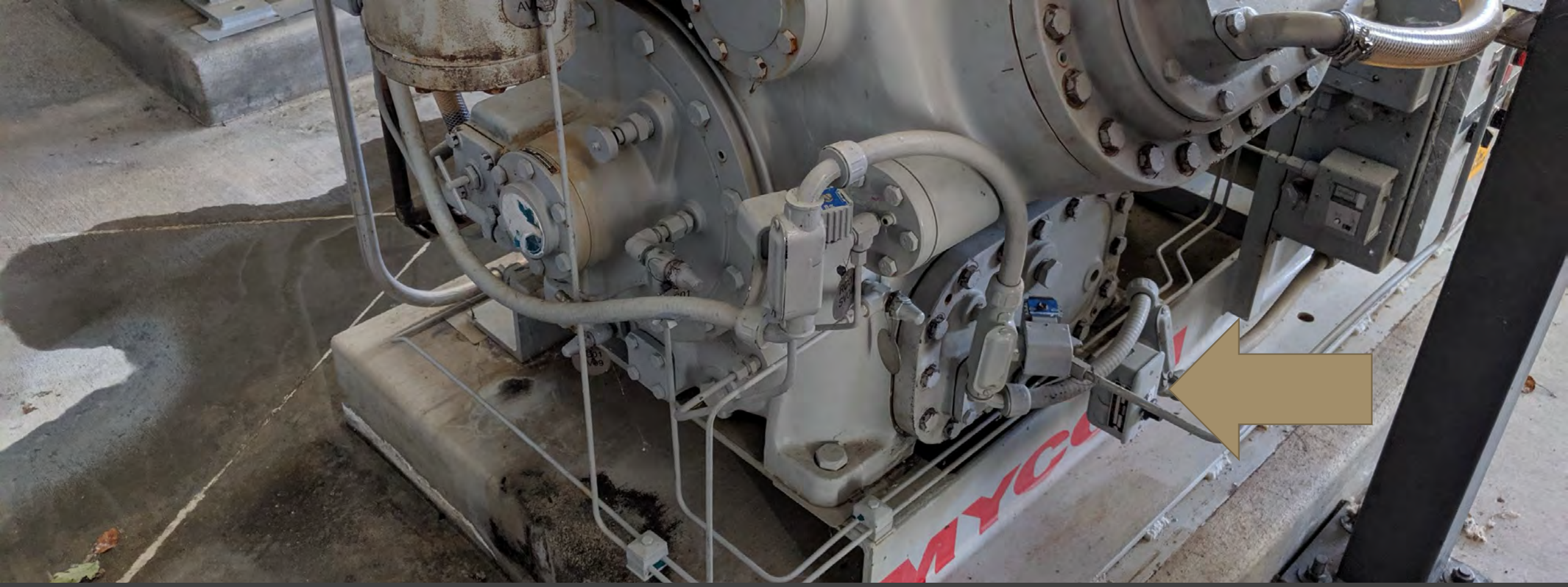
Visually inspect metal surfaces for pitting or surface damage

ANNUAL INSPECTIONS

Visually inspect coupling for wear

ANNUAL INSPECTIONS

Visually inspect starter connections and associated timers and relays



ANNUAL INSPECTIONS

Inspect operation of oil heaters

MONTHLY INSPECTIONS

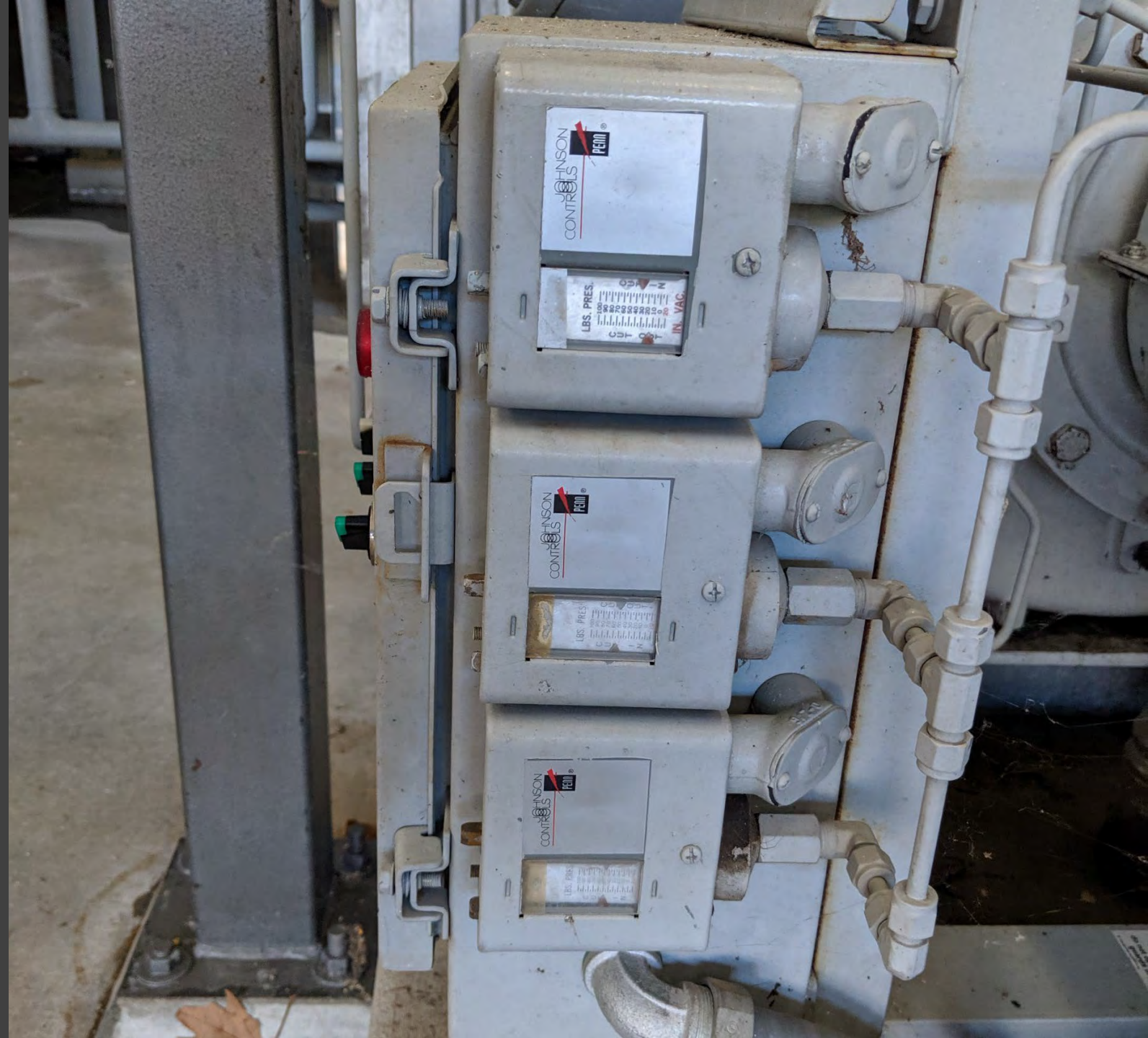
Inspect operation of unloader

ANNUAL INSPECTIONS

Inspect alignment of motor drive shaft

ANNUAL TESTS

Test low suction pressure cutout



ANNUAL TESTS

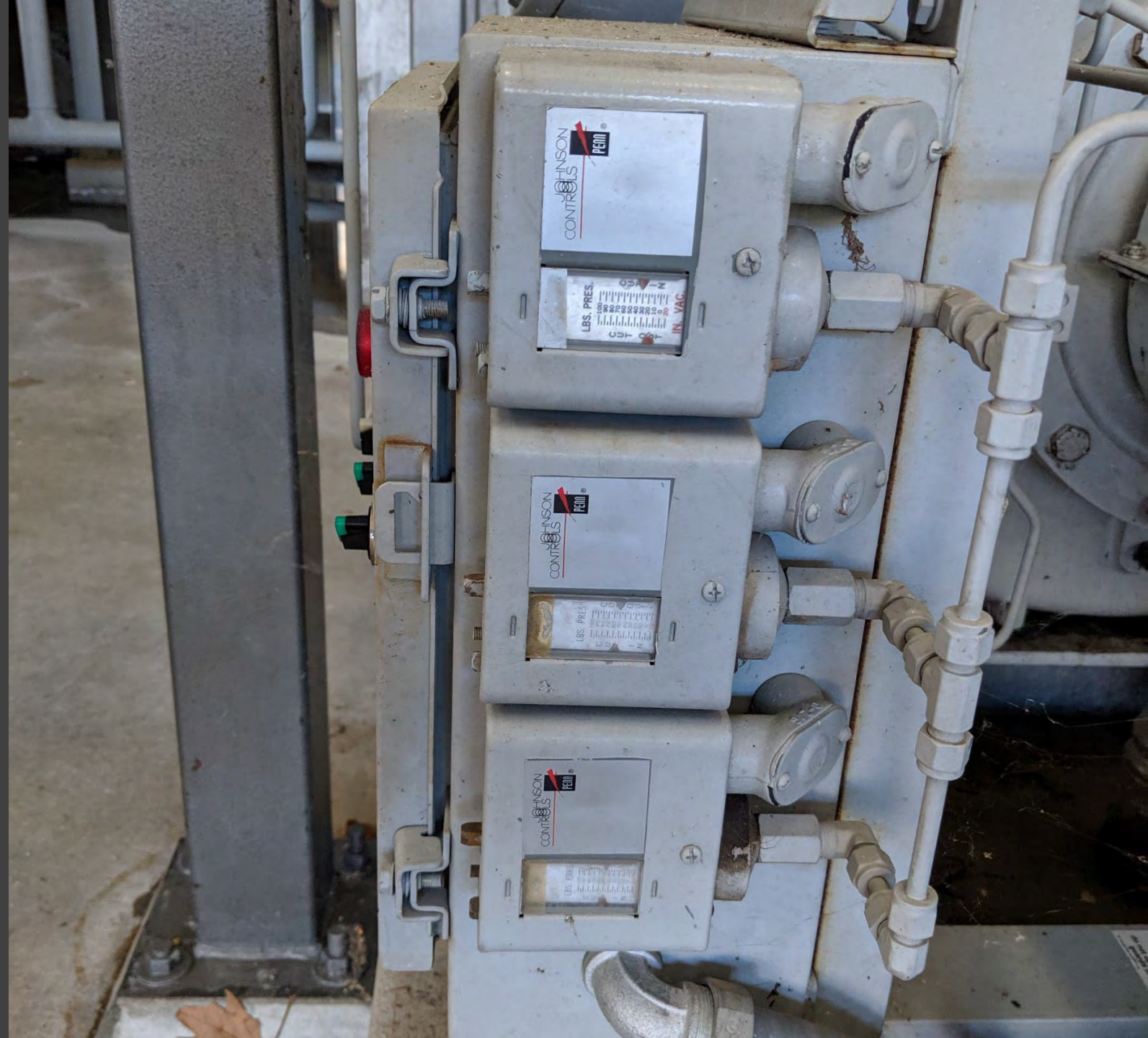
Test high discharge pressure cutout

ANNUAL TESTS

Test high discharge temperature cutout

ANNUAL TESTS

Test low oil pressure cutout

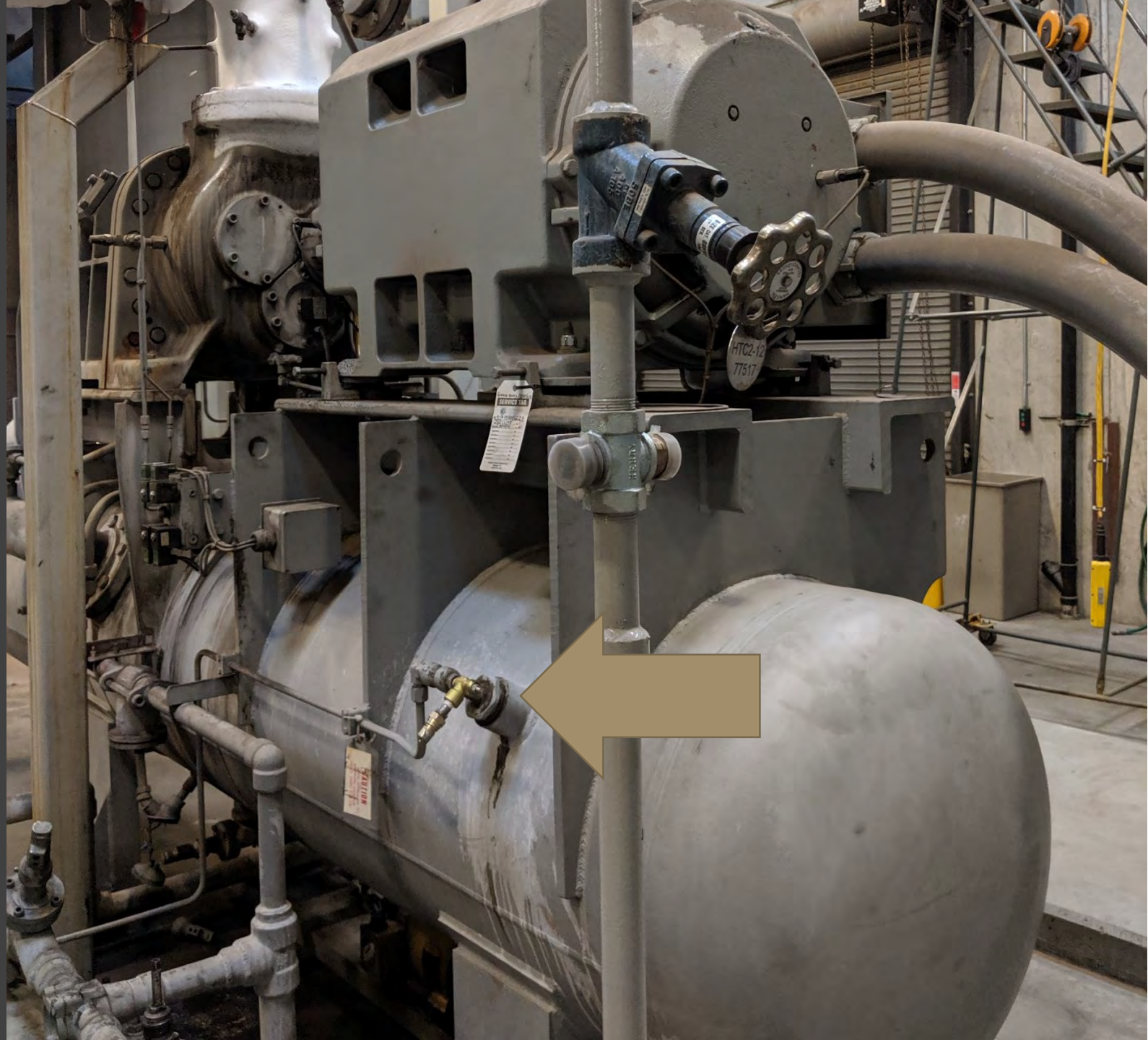


ANNUAL TESTS

Test high liquid level cutout

MAINTENANCE

Add oil (as needed)



MAINTENANCE

Change oil filter (as indicated by ΔP, runtime hours, oil analysis)

MAINTENANCE

Clean external oil pump
(5-Years)

MAINTENANCE

Oil Analysis (annual)

POLARIS Laboratories

Lubricant Analysis Report

North America: +1-877-808-3750

0 | 1 | 2 | 3 | 4 (1 = NORMAL, 2 = ABNORMAL, 4 = CRITICAL)

Overall report severity based on comments.

Account Information		Component Information		Sample Information	
Account Number:	401110-8241-0645	Component ID:	SB-4	Tracking Number:	18178Y06677
Company Name:	FOSTER FARMS (PORTERVILLE, CA)	Secondary ID:		Lab Number:	I-115134
Contact:		Component Type:	AMMONIA SCREW COMPRESSOR	Lab Location:	Indianapolis
Address:		Manufacturer:	FES	Data Analyst:	JAS
		Model:	Information Requested	Sampled:	02-Oct-2018
Phone Number:		Application:	PLANT/INDUSTRIAL	Received:	09-Oct-2018
		Sump Capacity:		Completed:	10-Oct-2018

Filter Information		Miscellaneous Information		Product Information	
Filter Type:	Information Requested	Miscellaneous:	NONE	Product Manufacturer:	Information Requested
Micron Rating:	0			Product Name:	Information Requested
				Viscosity Grade:	Information Requested

Comments: Flagged data does not indicate an immediate need for maintenance action. Continue to observe the trend and monitor equipment and fluid conditions. Tin is at a MINOR LEVEL;

	Wear Metals (ppm)										Contaminant Metals (ppm)			Multi-Source Metals (ppm)						Additive Metals (ppm)				
Sample #	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
1	3	0	0	0	0	0	2	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	1	1

	Sample Information							Contaminants			Fluid Properties					
Sample #	Date Sampled	Date Received	Lube Time h	Unit Time h	Lube Change	Lube Added gal	Filter Change	Fuel Dilution % Vol	Soot % Vol	Water % Vol	Viscosity 40°C cSt	Viscosity 100 °C cSt	Acid Number mg KOH/g	Base No. D4739 mg KOH/g	Oxidation abs/cm	Nitration abs/0.1 mm
1	02-Oct-2018	09-Oct-2018	0	11151	No	0	No			0 - mo. 6304C	64.9		0.01			

	Particle Count (particles/mL)										Additional Testing
Sample #	ISO Code Based On 4/6/14	> 4 µm	> 6 µm	> 10 µm	> 14 µm	> 21 µm	> 38 µm	> 70 µm	> 100 µm	Test Method	

MAINTENANCE

Align external oil pump shaft (5-years)

MAINTENANCE

Change oil (oil analysis, runtime, or annual)

MAINTENANCE

Verify coupling bolts are tight (annual)

MAINTENANCE

Replace shaft seal (as needed)

MAINTENANCE

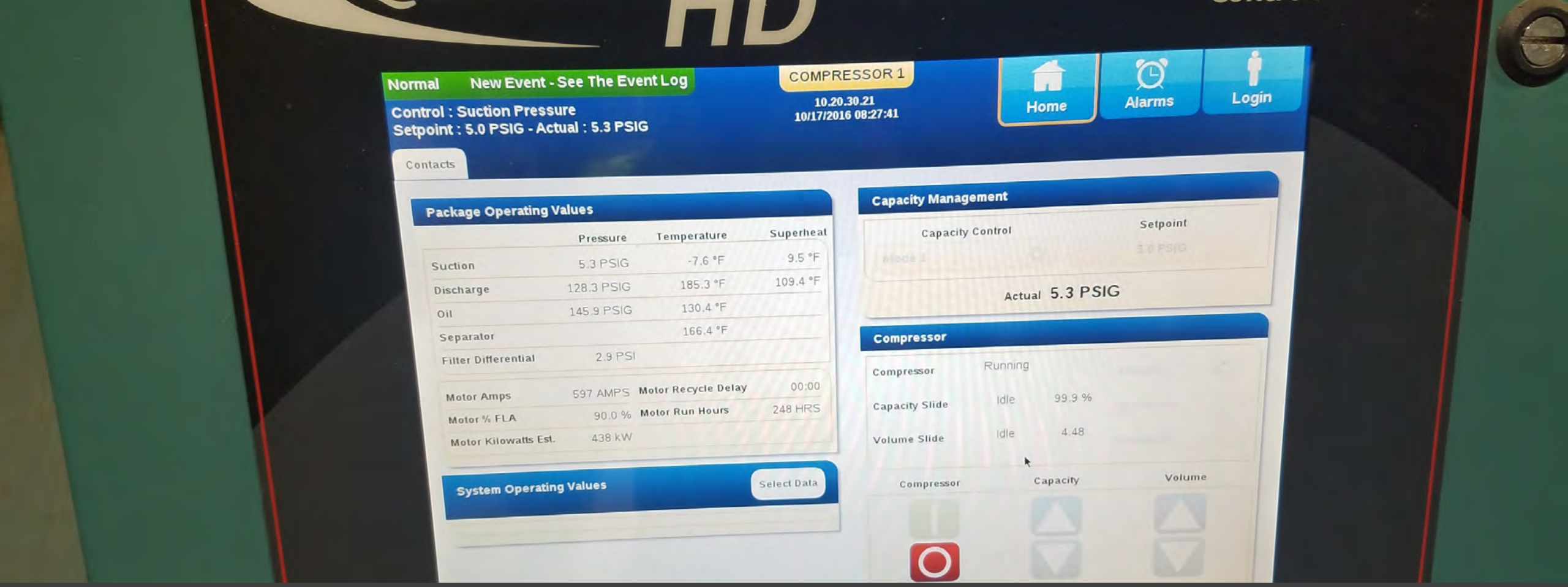
Measure (hot) compressor-motor drive shaft alignment (annual)

MAINTENANCE

Lubricate compressor and external oil pump electric motor bearings (semi-annual)

MAINTENANCE

Remove electrical connection box and check motor leads and insulation (annual)



MAINTENANCE

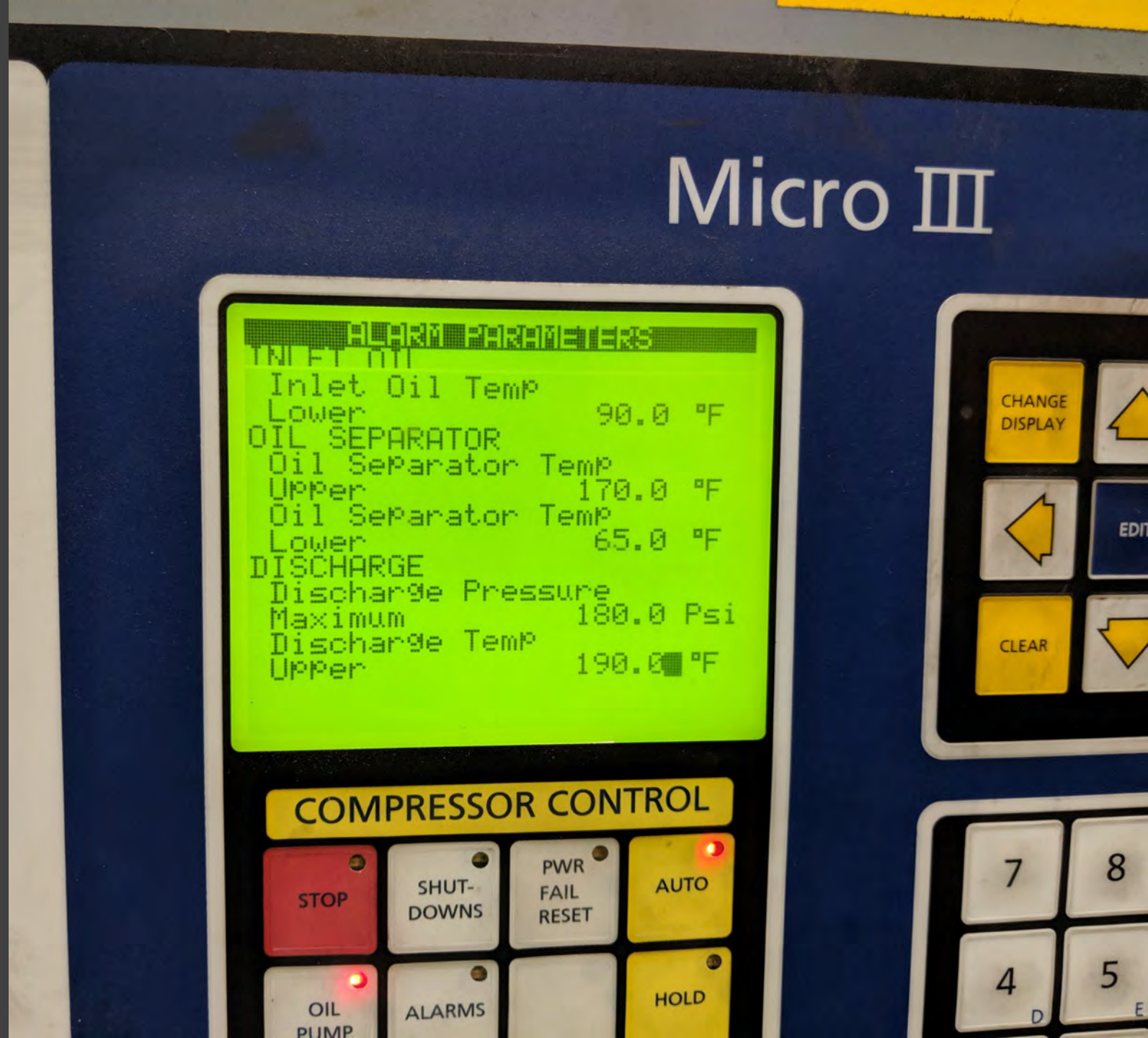
Verify integrity of control power (annual)

MAINTENANCE

Verify integrity of starter connections (annual)

MAINTENANCE

Calibrate pressure and temperature cutout switches (annual)



MAINTENANCE

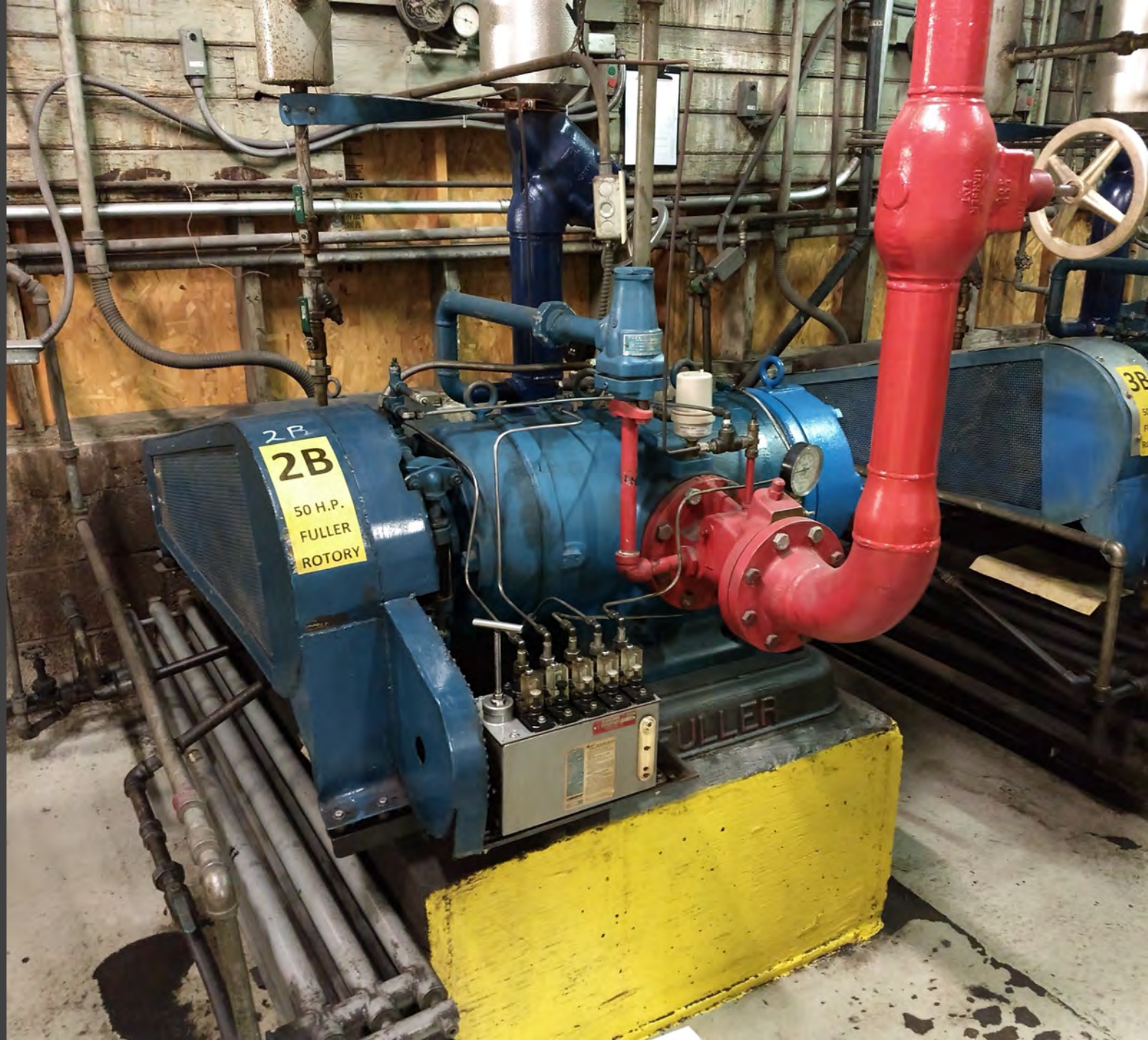
Inspect for rotor axial play in motor driven rotor shaft (annual)

MAINTENANCE

Inspect pistons, rings, and plate valves (5-years)

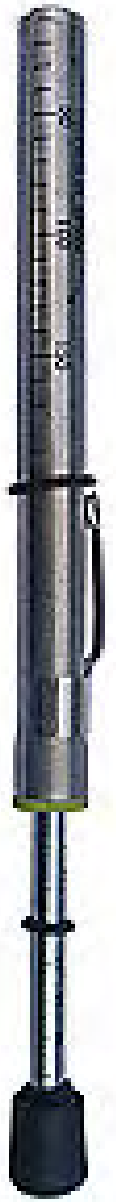
MAINTENANCE

Inspect vanes (5-years)



MAINTENANCE

Check belt tension
(annual)



MAINTENANCE

Check pulley hub connections (annual)

MAINTENANCE

Check electrical wiring for hot spots (annual)