

## Mechanical Integrity Maintenance Procedure Index

### Annual Certification of Maintenance Procedures

I hereby certify these active maintenance procedures were developed utilizing input and review of the employees and are current and accurate as of their individual effective date.

Name: \_\_\_\_\_ Title: \_\_\_\_\_  
Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
:

### Administration

Procedure No.	Description	Directory	Date Issued	Rev #
MNT-ADM-001	Development of Maintenance Procedures	Administration	4/18/2013	0
MNT-ADM-002	QA/QC Plan	Administration	4/18/2013	0

### Electrical Equipment

Procedure No.	Description	Directory	Date Issued	Rev #
MNT-ELCT-001	Service/Maintenance for 600V Electrical Cable	Electrical	4/18/2013	0
MNT-ELCT-002	Field Testing/Troubleshooting of an Electric Motor	Electrical	4/18/2013	0
MNT-ELCT-003	Replacing Explosion Proof Receptacle	Electrical	4/18/2013	0
MNT-ELCT-004	Electrical Substation Periodic Inspection	Electrical	4/18/2013	0
MNT-ELCT-005	Cutler Hammer 600V Motor Starters	Electrical	4/18/2013	0
MNT-ELCT-006	Procedure for Substation Service Transformers	Electrical	4/18/2013	0
MNT-ELCT-007	Maintenance Procedure for Equipment Grounding	Electrical	4/18/2013	0
MNT-ELCT-008	Troubleshoot/Removal of a 480V Motor Starter	Electrical	4/18/2013	0
MNT-ELCT-009	Procedure for Replacing Lamps	Electrical	4/18/2013	0
MNT-ELCT-010	Megger Test for Insulation Breakdown	Electrical	4/18/2013	0
MNT-ELCT-011	UPS / Uninterruptable Power System Checkout	Electrical	4/18/2013	0

### Fixed Equipment

Procedure No.	Description	Directory	Date Issued	Rev #
MNT-FIXED-001	Remove, Clean and Re-Install Bundle from an Exchanger	Fixed Equip	4/18/2013	0
MNT-FIXED-002	Test and Repair of an Exchanger (in place)	Fixed Equip	4/18/2013	0
MNT-FIXED-003	Clean, Inspect and Repair of a Heater	Fixed Equip	4/18/2013	0
MNT-FIXED-004	Clean, Inspect and Repair of a Tower	Fixed Equip	4/18/2013	0
MNT-FIXED-005	Clean, Inspect and Repair of a Drum	Fixed Equip	4/18/2013	0
MNT-FIXED-006	Clean, Inspect and Repair of a Vessel	Fixed Equip	4/18/2013	0
MNT-FIXED-007	Clean, Inspect and Repair of a Tank	Fixed Equip	4/18/2013	0
MNT-FIXED-008	Installing Isolation Blind and/or Blind Flange to Processing Piping or Equipment	Fixed Equip	4/18/2013	0
MNT-FIXED-009	Installation/Removal of Screwed Piping Sections	Fixed Equip	4/18/2013	0
MNT-FIXED-010	Replacement of Flanged Piping Sections	Fixed Equip	4/18/2013	0

MNT-FIXED-011	Remove/Replace a Plug	Fixed Equip	4/18/2013	0
MNT-FIXED-012	Replacement of a Screwed Valve	Fixed Equip	4/18/2013	0
MNT-FIXED-013	Replacement of a Flanged Valve	Fixed Equip	4/18/2013	0
MNT-FIXED-014	Repack a Valve	Fixed Equip	4/18/2013	0
MNT-FIXED-015	Repair or Replace Steam Traps	Fixed Equip	4/18/2013	0
MNT-FIXED-016	"Hot Bolting" of a Flange	Fixed Equip	4/18/2013	0
MNT-FIXED-017	Hydrostatic Pressure Test for Shop Fabricated Pipe	Fixed Equip	4/18/2013	0
MNT-FIXED-018	Replacement of Butt or Socket Weld Piping Sections and Associated Components	Fixed Equip	4/18/2013	0
MNT-FIXED-019	Welding on Towers/Vessels or Exchangers	Fixed Equip	4/18/2013	0
MNT-FIXED-020	Install, Remove, or Modify Structure and Platforms	Fixed Equip	4/18/2013	0

## Inspection

Procedure No.	Description	Directory	Date Issued	Rev #
MNT-INSP-001	Inspection Procedure for Shell and Tube Heat Exchangers	Inspection	4/18/2013	0
MNT-INSP-002	Inspection Procedure for Active Non-Trayed Pressure Vessels	Inspection	4/18/2013	0
MNT-INSP-003	Inspection Procedure for Active Trayed Pressure Vessels	Inspection	4/18/2013	0
MNT-INSP-004	Inspection Procedure for Air Cooled Heat Exchangers	Inspection	4/18/2013	0
MNT-INSP-005	Inspection Procedure for Leak Testing	Inspection	4/18/2013	0
MNT-INSP-006	Inspection Procedure for Fired Heaters	Inspection	4/18/2013	0
MNT-INSP-007	Inspection Procedure for Liquid Penetrant Examination	Inspection	4/18/2013	0
MNT-INSP-008	Inspection Procedures for Pressure Relieving Devices	Inspection	4/18/2013	0

## Instrumentation

Procedure No.	Description	Directory	Date Issued	Rev #
MNT-INST-001	High Risk Equipment Calibration	Instruments	4/18/2013	0
MNT-INST-002	Analytical Equipment	Instruments	4/18/2013	0
MNT-INST-003	Testing Alarm Devices & Shutdowns	Instruments	4/18/2013	0
MNT-INST-004	Function Check/Removal/Installation of a Honeywell Smart Pressure Transmitter	Instruments	4/18/2013	0
MNT-INST-005	Shop Checkout Procedure for the Rosemount Model 1151 Pressure Transmitter	Instruments	4/18/2013	0
MNT-INST-006	Shop Checkout Procedure for the Rosemount Model 1151 Differential Pressure (D/P) Transmitter	Instruments	4/18/2013	0
MNT-INST-007	Shop Checkout Procedure Moore Industries MVX Millivolt Transmitter	Instruments	4/18/2013	0
MNT-INST-008	Shop Checkout Procedure Ashcroft (Duragauge) Standard Pressure Gauge	Instruments	4/18/2013	0
MNT-INST-009	Functional Check of a Teledyne Analytical Portable Flue Gas Analyzer (Model 980)	Instruments	4/18/2013	0
MNT-INST-010	Shop Checkout Procedure for the Fisher Pneumatic Level Controller/Indicator Transmitters with Cage (External Float) or Cageless (Internal Float) Displacer Sensors	Instruments	4/18/2013	0
MNT-INST-011	Shop Checkout Procedure for the Fisher Type 546 Electro-Pneumatic Transducer (I/P)	Instruments	4/18/2013	0
MNT-INST-012	Shop Transmitter Checkout Procedure for the Honeywell Smart Transmitter	Instruments	4/18/2013	0
MNT-INST-013	Shop Testing/Repair of Single and Double Ported, Plug Type, & Diaphragm Actuated Control Valves	Instruments	4/18/2013	0

MNT-INST-014	Function Check/Removal/Installation of a Flow Transmitter (Honeywell Smart)	Instruments	4/18/2013	0
MNT-INST-015	Function Check/Removal/Installation of a Pressure Transmitter (Honeywell Smart)	Instruments	4/18/2013	0
MNT-INST-016	Function Check/Removal of a Cage Type Displacer Level Transmitter	Instruments	4/18/2013	0
MNT-INST-017	Function Check/Removal of a Control Valve	Instruments	4/18/2013	0
MNT-INST-018	Function Check of a Precision Continuous Viscometer	Instruments	4/18/2013	0
MNT-INST-019	Replacement of a Butterfly Valve	Instruments	4/18/2013	0
MNT-INST-020	Installation/Removal/Function Check of a Pressure Switch	Instruments	4/18/2013	0

## Rotating Equipment

Procedure No.	Description	Directory	Date Issued	Rev #
MNT-MACH-001	Shop Repairs to a Horizontal Barrel Centrifugal Pump	Machinists	4/18/2013	0
MNT-MACH-002	Rebuild & Certify Relief Valves Per State Code	Machinists	4/18/2013	0
MNT-MACH-003	Shop Repairs to a Horizontal Split Case Pump	Machinists	4/18/2013	0
MNT-MACH-004	Shop Repairs to a Vertical In-Line Pump	Machinists	4/18/2013	0
MNT-MACH-005	Shop Repairs to a Vertical Sump Pump	Machinists	4/18/2013	0
MNT-MACH-006	Shop Repairs to a Turbine	Machinists	4/18/2013	0
MNT-MACH-007	Shop Repairs to a Reciprocating Chemical Injection Pump	Machinists	4/18/2013	0
MNT-MACH-008	Shop Repairs to a Gearbox	Machinists	4/18/2013	0
MNT-MACH-009	Shop Repairs to a Centrifugal Compressor	Machinists	4/18/2013	0
MNT-MACH-010	Shop Repairs to a Mixer	Machinists	4/18/2013	0
MNT-MACH-011	Shop Repairs to a Fan or Blower	Machinists	4/18/2013	0
MNT-MACH-012	Shop Repairs to a Gear Pump	Machinists	4/18/2013	0
MNT-MACH-013	Remove, Repair, and Reinstall a Horizontal Pump	Machinists	4/18/2013	0
MNT-MACH-014	Remove, Repair, and Reinstall a Reciprocating Pump	Machinists	4/18/2013	0
MNT-MACH-015	Remove, Repair, and Reinstall a Turbine	Machinists	4/18/2013	0
MNT-MACH-016	Remove and Reinstall an Electric Motor	Machinists	4/18/2013	0
MNT-MACH-017	Remove, Repair, and Reinstall a Fan	Machinists	4/18/2013	0
MNT-MACH-018	Remove, Repair, Reinstallation of a Gearbox	Machinists	4/18/2013	0
MNT-MACH-019	Replacement of Valves on a Reciprocating Compressor	Machinists	4/18/2013	0
MNT-MACH-020	Remove, Repair and Reinstall a Horizontal Split Case Pump Motor Driven	Machinists	4/18/2013	0
MNT-MACH-021	Remove, Repair and Reinstall a Horizontal Gear Pump Motor Driven	Machinists	4/18/2013	0
MNT-MACH-022	Remove, Repair and Reinstall a Vertical Sump Pump Motor Driven	Machinists	4/18/2013	0
MNT-MACH-023	Remove, Repair and Reinstall a Vertical In-Line Pump Motor Driven	Machinists	4/18/2013	0
MNT-MACH-024	Remove, Repair and Reinstall a Reciprocating Pump Motor Driven	Machinists	4/18/2013	0
MNT-MACH-025	Remove, Repair and Reinstall a Horizontal Split Case Pump Turbine Driven	Machinists	4/18/2013	0
MNT-MACH-026	Remove, Repair and Reinstall a Mixer on a Tank	Machinists	4/18/2013	0
MNT-MACH-027	Repack a Centrifugal Pump	Machinists	4/18/2013	0
MNT-MACH-028	Repairs to API Separator (Skimmer)	Machinists	4/18/2013	0
MNT-MACH-029	Remove, Repair and Reinstall a Vertical Water Well Motor Driven	Machinists	4/18/2013	0
MNT-MACH-030	Removal, Repair, Install a Cooling Tower Fan and Gear Box	Machinists	4/18/2013	0
MNT-MACH-031	Turbine Overspeed Test Procedure	Machinists	4/18/2013	0

## Rigging

Procedure No.	Description	Directory	Date Issued	Rev #
MNT-RIG-001	Choker, Wire Rope Sling, Metal Mesh Sling, Synthetic Webbing Slings, & Natural/ Synthetic Fiber Rope Inspection	Rigging	4/18/2013	0
MNT-RIG-002	Hand Operated, Electrical or Air-Powered Chain Hoists & Hook Inspection	Rigging	4/18/2013	0
MNT-RIG-003	Mobile Crane & Standing Wire Rope Inspection	Rigging	4/18/2013	0
MNT-RIG-004	Mobile Crane Lifting Procedures	Rigging	4/18/2013	0
MNT-RIG-005	Tackle Blocks, Eye Bolts, & Shackles Inspection	Rigging	4/18/2013	0

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## Development of Maintenance Procedures

APPROVED: \_\_\_\_\_ DATE APPROVED: \_\_\_\_\_ DATE EFFECTIVE: \_\_\_\_\_  
Maintenance Manager

<b>PURPOSE</b>	This procedure defines the YOUR COMPANY NAME HERE Maintenance procedures. The process for procedure, development, review, approval, document control and formatting standards are described.
<b>REFERENCES</b>	Department of Labor (OSHA), 29 CFR part 1910.119, <b><u>Process Safety Management of Highly Hazardous Chemicals</u></b> , Final Rule, February 24, 1992.  American Petroleum institute, API Recommended Practice 750, "Management of Process Hazards", January 1990.
<b>DEFINITIONS</b>	<p><b><u>APPROVAL</u></b> -- Authorization granted by the Maintenance Manager to issue a new procedure or revision, delete an approved procedure, or implement a field change. Approval authority shall not be delegated, except in the absence of the Maintenance Manager.</p> <p><b><u>CONTROL COPY</u></b> -- A control copy is the only version of a procedure which is considered up-to-date at all times. Working copies shall be reproduced from a control copy.</p> <p><b><u>DATE APPROVED</u></b> -- The date a procedure is approved by the Maintenance Manager and becomes authorized for use. This means the content of the procedure is satisfactory and the procedure is to be implemented.</p> <p><b><u>DELETED PROCEDURE</u></b> -- A procedure rescinded and not replaced by a later revision. The procedure's number will not be reused.</p> <p><b><u>EXPIRATION DATE</u></b> -- The date or condition after which a <b>TEMPORARY PROCEDURE</b> will no longer be used.</p> <p><b><u>INTENT CHANGE</u></b> -- A change to the content of a control copy which:</p> <ul style="list-style-type: none"><li>• Changes the purpose or outcome</li><li>• Creates new process safety issues</li><li>• Changes any operating parameter or limit</li><li>• Causes other Departments to perform tasks not previously required.</li></ul> <p><b><u>NON-INTENT CHANGE</u></b> -- A change to a procedure which does not change the purpose, safety concerns, parameters, flow paths or the validity of any data taken. Such changes may include the following:</p> <ul style="list-style-type: none"><li>• Clearly identifiable typographical errors, misspelled words and correction to punctuation</li><li>• Inadvertently omitted information or clearly erroneous data</li><li>• References to other documents which must be corrected due to the reference document title, number, or revision number changing</li></ul> <p><b><u>MAINTENANCE MANAGER</u></b> -- The Manager who is responsible for the equipment or operation will sponsor applicable procedures and has the approval authority.</p>

**MAINTENANCE PROCEDURE** - identifies hazards associated with employees job task. Field procedures will contain information to assure that the employee can perform the job task in a safe manner. A Maintenance Procedure shall include, where applicable, specific instructions and values as needed to execute the job correctly, e.g., manufacturer's "bolt torque" specifications.

**REVISION** -- The process of incorporating approved changes into a control copy which results in a change in the procedure's revision number.

**TEMPORARY PROCEDURE** -- A procedure intended for one use that has a finite life (that is, a specified effective date and expiration date or predefined condition.)

**USE OF SHALL, SHOULD AND MAY** -- These words have definite meanings:

- **SHALL** denotes a requirement
- **SHOULD** denotes a recommendation
- **MAY** denotes permission (that is, neither a requirement nor a recommendation)

**WORKING COPY** -- A procedure either under development or revision.

## PROCEDURE USAGE

**PROCEDURE AVAILABILITY** -- Plant procedures shall be readily accessible to all workers who perform Maintenance activities. The procedures shall be written to provide clear instructions for safely performing work activities.

**USER RESPONSIBILITY** -- Each worker is responsible for reviewing the procedures for their area of responsibility as often as necessary to ensure adherence to current operating and maintenance practices.

## MAINTENANCE PROCEDURES

Maintenance Procedures will identify any specific hazards associated with the job, along with any exposure effects and references to Material Safety Data Sheets for treatment required.

Maintenance Procedures need to be specific to the type of equipment. Identical or very similar items of equipment in similar service need not have individualized procedures. Each procedure must clearly identify the equipment to which it applies.

These procedures will contain specific job instructions on "how to do the job correctly". When tasks have to be done in a fixed, specific sequence and special instructions need to be followed, these will be included as part of the procedure.

Maintenance Procedures will also identify any initial conditions (prerequisites) that must be satisfied or actions that should be performed prior to starting the procedure (i.e., Lock and Tag, obtain Work Permit, etc.).

Procedures will reference other guidelines, such as ISA, NEC, ASME, or API, as they apply to each individual procedure. Manufacturer's manuals and/or drawings will also be referenced as applicable.

## PROCEDURE DEVELOPMENT

The need for new procedures or procedure revisions may be identified or initiated by anyone.

The Maintenance Manager is responsible for arranging for procedure(s) be written according to the format and writing standards described in this document. Capital projects and other process engineering changes should automatically initiate development of procedures or revisions to procedures as part of the Management of Change (MOC) process.

## REVIEW AND APPROVAL

Prior to approval, each new procedure or procedure revised for an intent change or due to periodic review comments will be reviewed to ensure that it addresses the following:

- Safety
- Technical accuracy
- Regulatory requirements
- Sound operating and maintenance practices
- Quality

## PROCEDURE CONTROL

The master document shall be titled as a "Control copy". A Control copy is the only version considered up-to-date at all times. All other copies of procedures are "For Information Only" and should be compared with the Control copy prior to use to ensure that they are current and to include all field changes.

**WORKING COPIES** – Procedures titled as "Working Copy" will not be considered as current.

**NON-INTENT CHANGES** - should be written in ink on a Controlled Copy, signed and dated by the person making the change and submitted for correction.

## PROCEDURE REVIEW

Procedures will be reviewed as often as necessary to ensure that they reflect current operating practice, including changes that result from changes to process chemicals, technology, and equipment, and changes to facilities.

The Maintenance Managers will certify annually that the procedures are current and accurate. Each procedure's 12 month review cycle will restart immediately following the approval of a revision to the procedure. Procedure revisions identified as a part of the MOC review of other process safety information changes must be reviewed and approved in accordance with this procedure.

When a procedure is formally revised the Maintenance Manager will ensure that the earlier versions are removed and the latest revision inserted in its place. Revised procedures will be published and distributed in their entirety. The Maintenance Manager shall ensure all employees affected by the new or revised procedure will be informed of or trained in the change prior to the effective date.

## TEMPORARY PROCEDURES

Temporary procedures are written for a temporary situation or condition. Each temporary procedure has an effective date and an end date or when a predefined condition is satisfied. Temporary procedures will be centrally archived after their expiration date.

Temporary procedures shall be marked "**TEMPORARY**" after the title. They will include an expiration date or terminating condition in the Purpose section. Temporary procedures may be hand written if the writing is clear and legible.

## PROCEDURE FORMAT

Procedure pages will include a header and footer containing the following information:

**PROCEDURE NUMBER** -- An alphanumeric code consisting of:

1. Procedure Type Indicator – e.g. MNT
2. Craft prefix number - e.g. FIXED, INST
3. Sequential number - e.g. 001, 002
4. Revision Number - e.g. 0, 1 (The first revision is Rev. 1)

**PROCEDURE TITLE** -- A summary of the major goal of the procedure, usually a major job or task description. For example: "Unit #1 Startup" or "Loading Product Tank Cars"

**APPROVED BY** -- Signature of approval authority by the Maintenance Manager. This line appears on the top of the first page only.

**DATE** -- Month and year when the current revision of the procedure was approved and published.

**PAGE NUMBER** -- Each procedure begins on page one and is numbered consecutively through the last page of the procedure. Each page shows the page number and the total number of pages in the procedure (including attachments). For example, the last page of a three-page procedure is Page 3 of 3.

## TABLES AND FIGURES

Tables, simple drawings, exploded drawings, figures, diagrams, and charts serve to clarify confusing or difficult ideas. Locate them close to the point in the procedure where they are referenced. If complicated drawings are necessary for understanding the procedure they may be included as attachments. If this is not practical (as with vendor manuals or numerous detailed PFDs) the procedure user should be directed to the appropriate document.

## PROCEDURE SECTION

Maintenance procedures contain the following sections, identified in the left margin of each procedure:

1. **PURPOSE** -- A brief description of summary of the use and goal of the procedure.
2. **REFERENCES** -- Documents that support the maintenance work being performed. In case of possible chemical exposure, include references to appropriate MSDS, using the actual chemical name(s).



3. **PRECAUTIONS** -- A brief description of any dangerous conditions that exist or could be encountered while performing the procedure as identified by a Job Hazard Analysis.
4. **SPECIAL TOOLS AND EQUIPMENT** -- A list of equipment or materials unique to the procedure or which should be in place before beginning the procedure. This section would not include normal Personal Protection Equipment (PPE) worn to meet general plant safety requirements.
5. **PREREQUISITES** -- Actions or conditions which shall be performed or verified before starting the procedure. The technician skill level that the work requires will be stated here. Other job planning information is identified here as well as special training and regulatory requirements.
6. **PROCEDURE** -- The step-by-step instructions for achieving the purpose of the procedure.

Procedural steps will consist of an action and the object of the action. For example:

- Mechanic**
1. **VISUALLY INSPECT gasket seat for signs of rusting or pitting.**
  2. **WIPE the gasket seat area with a cloth soaked in machine oil.**

**NOTES** contain information that will help in the performance or understanding of a procedural step. Notes will precede the procedural step to which they refer. It is advisable to limit the use of "nice to know information" in notes as well as in procedural steps. Notes do not normally contain actions. Notes will be designated as shown below:

**CAUTIONS** are placed **before** a step to identify potential or actual hazards that could injure personnel, damage equipment or reduce a component's mechanical integrity.

#### END OF PROCEDURE

The centered word { **END** }, in bold type, shall appear after the last step or paragraph of a procedure.

**END**

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## Service/Maintenance Procedure for 600V Electrical Cable

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APPROVED: \_\_\_\_\_ DATE APPROVED: \_\_\_\_\_ DATE EFFECTIVE: \_\_\_\_\_  
Maintenance Manager

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**PURPOSE** This procedure describes the service and maintenance of 600V electrical cable. This procedure applies to all electrical personnel that perform or assist in this work. All Maintenance Electrical Personnel that perform or assist in accomplishing this work will follow all procedures.

**REFERENCES**

- MATERIAL SAFETY DATA SHEETS
- Safe Work Permit Procedure
- Lock Out/ Tag Out Procedure
- Safety Manual

**SPECIAL EQUIPMENT** Minimum 5KV Megger with 20,000 Mohm scale.

**PREREQUISITE** This procedure requires qualified craftsmen.

1. REVIEW this procedure with the electrical personnel to ENSURE all steps and cautions are CLEAR and all hazards have been DEFINED.
2. Electrical personnel shall VERIFY that all safety equipment in the sub station is in good working order.
3. If electrical lockout is required, REFER to Lock Out/ Tag Out Procedure.
4. When involving electrical distribution, NOTIFY central control operators that a power distribution system will be out of service, and what will be affected.
5. Refer to Electrical Switching Orders Procedure.

**PRECAUTION** Personnel will be exposed to low or high voltages. The following hazards are associated with electrical energy and safety precautions must be exercised:

1. Shock
2. Arc (Flash)
3. Blast

Exposure or contact with any of these hazards will result in burns, severe and/or possibly fatal injuries. Wear proper protective gear, barricade area to be tested.

**PROCEDURE**

SERVICE/MAINTENANCE FOR 600V POWER CABLES

1. The circuit must be DE-ENERGIZED and ISOLATED before beginning work.
2. Visually inspect grounding, cable support and termination.
3. Perform Testing Procedure for 600V cable, per industry practices.
- 4.. TEST leads must be in good shape, CLEAN and having no broken or cracked insulation.

**CAUTION**  
DO NOT TOUCH CABLE DURING TEST.  
**CAUTION**

5. DOCUMENT all test results and work done in proper files. All test results are to be reviewed and kept by the electrical supervisor.

**DURATION**

Interval for testing and maintenance: Testing and maintenance as outlined above shall be done on the cable covered by this procedure at an interval NOT TO EXCEED 5 YEARS. The electrical supervisor or his designee will implement the timing based on schedules and maintenance work.

**END**

## 600V CABLE TEST

CABLE SERVICE (Project Name) _____	LOCATION (Area in Plant) _____
DATE OF TEST _____	WEATHER COND. _____
AMBIENT TEMP. (Degree F) _____	FREE AIR PROBE TEST RESULTS _____
PERSON(S) PERFORMING TEST & COMPANY AFFILIATION _____	

Description Circuit No., Ect.	Cable Type (XHHW or RHH/RHW/USE and Size)	1 Approx. Length (Ft.)	2 Megohms (For Run)	3 Megohms-1000 Ft (2)x(1)/1000 Ft	4 Temperature Correction Factor (From Table)	5 Megohms-1000 Ft. Corrected to 60 deg. F (3)x(4)	6 Megohms-1000 Ft. (Minimum Acceptable) (From Table)	Comments Acceptable(?)

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## Remove, Clean, and Re-Install Bundle from an Exchanger

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APPROVED: \_\_\_\_\_ DATE APPROVED: \_\_\_\_\_ DATE EFFECTIVE: \_\_\_\_\_  
Maintenance Manager

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**PURPOSE** This Procedure describes the steps required to remove the tube bundle from an exchanger. This procedure applies to all Maintenance personnel that perform or assist in this work.

**REFERENCES**

- MATERIAL SAFETY DATA SHEETS
- Hazardous Energy Control Procedure
- Safe Work Permit Procedure
- Lock Out/ Tag Out Procedure
- Lifting Procedure
- Safe Work Program for Handling Inorganic Metals in Process Scales
- Welding on Towers/Vessels or Exchangers Procedure

**SPECIAL EQUIPMENT** Refer to proper MATERIAL SAFETY DATA SHEETS

**PREREQUISITE** This procedure requires qualified craftsmen.

1. REVIEW this procedure with the Operations and Maintenance crews to ENSURE all steps and cautions are clear and all hazards have been DEFINED. Match the proper MATERIAL SAFETY DATA SHEETS with the equipment service.
2. Use special precautions defined on MATERIAL SAFETY DATA SHEETS and verify operation of all safety showers and eyewashes near the work area to ENSURE they are in good working order.
3. Field VERIFY with Operations that the equipment has been BLOCKED IN, DE PRESSURIZED, and BLED DOWN. VERIFY that block valves are HOLDING satisfactorily.
4. INSTALL locks and tags where required per the Lock Out/ Tag Out Procedure.
5. Maintenance personnel shall VERIFY with the unit operator that all applicable equipment is LOCKED and TAGGED OUT and is NON-OPERABLE (Lock, Tag, Test, Try).
6. REVIEW and OBTAIN Work Permit at this time.

**PROCEDURE** REMOVE, CLEAN, AND RE-INSTALL TUBE BUNDLE FROM AN EXCHANGER IN THE VACUUM-I UNIT.

**CAUTION**

"First Flange Break" - Personnel must stand upwind of flange being broken to lessen exposure to hazard. Personnel shall loosen and remove bolts on far side of flange first to lessen chances of exposure.

**CAUTION**

1. INSTALL blinds on the shell side inlet and outlet nozzles if required.
2. REMOVE channel cover and channel head.
3. INSTALL blind flanges on the tube side inlet and outlet piping if required.
4. PULL bundle.
5. Hydro-blasters to CLEAN tubes, bundle and heads if required.
6. Inspection Department to INSPECT all parts.
7. REPAIR as needed per Inspection Memo.
8. RE-ASSEMBLE exchanger, except for channel cover.
9. OBTAIN test pressures from Operations.
10. HYDROTEST shell side and complete hydrotest forms. Cold gas oil must be used to test.
11. RE-INSTALL channel cover, Hydrotest tubes, complete Hydrotest forms. Cold gas oil must be used to test.

**CAUTION**

"First Flange Break" - Personnel must stand upwind of flange being broken to lessen exposure to hazard. Personnel shall loosen and remove bolts on far side of flange first to lessen chances of exposure.

**CAUTION**

12. REMOVE all blinds.
  13. NOTIFY Operations that work is complete.
  14. REMOVE all locks and tags.
  15. After system is back in service, Operations will SIGN OFF the Work Order/Work Permit as completed.
- \* **Note:** During turnaround or complete unit shutdown with all isolation blinds in place, water may be used to Hydrotest exchangers if there is sufficient steam in the unit to effectively steam out exchangers after testing.

**END OF PROCEDURE**

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## INSPECTION PROCEDURE FOR SHELL AND TUBE HEAT EXCHANGERS

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APPROVED: \_\_\_\_\_ DATE APPROVED: \_\_\_\_\_ DATE EFFECTIVE: \_\_\_\_\_

Technical Writer: \_\_\_\_\_

Content Expert: \_\_\_\_\_

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### Purpose

Establish inspection guidelines to ensure mechanical integrity and continued reliable operation of shell and tube heat exchangers. This procedure applies to the pressure containing parts of the exchanger along with supporting structures.

### References

Material Safety Data Sheets (MSDS) are electronically stored and can be referred to in the MSDS program by equipment number, MSDS can also be found by searching by manufacturer, product name, or chemical. The procedure user is responsible for referring to the appropriate MSDS.

Corporate Safety Procedures shall be referred to for all safety related issues. They are accessible electronically plant wide by going to the Health and Safety Services tab on the Intranet. Personnel are responsible for referring to the appropriate safety procedures.

National Board Inspection Code ANSI-NB-23, Latest Edition

API-510 Pressure Vessel Inspection Code: Maintenance Inspection, Rating, Repair, and Alteration; Latest Edition

American Society of Mechanical Engineers (ASME), Section VIII, Division 1

American Society of Mechanical Engineers (ASME), Section IX, Latest Edition

Applicable Local, State and Federal Regulations

Applicable Engineering Standards and Practices API

RP571 Conditions Causing Deterioration and Failure

API RP572 Inspection of Pressure Vessels

API RP750 Management of Process Hazards

Applicable Maintenance Inspection Procedures

Vendor Drawing for the vessel being inspected.

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## INSPECTION PROCEDURE FOR SHELL AND TUBE HEAT EXCHANGERS

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**Precautions** The Authorized Inspector should assure that all work permits, isolation and entry procedures/permits are current.

**Prerequisites** Prior to any inspection, a review should be done through Reliability Equipment Files and facility databases:

- Inspection history
- Current mechanical design requirements
- Previous repair history
- Re-rating history material degradation
- Corrosion rates

The Authorized inspector should take into consideration operating conditions and the process chemistry the equipment is subjected to and determine potential degradation mechanisms.

**Procedure**

**External Inspection**

- External inspection of an air cooled exchanger is part of the determination of mechanical integrity.
- Then Authorized Inspector should examine platforms, ladders, stairways, and their supports (including fireproofing), to assure their serviceability.
- The concrete pedestals, foundations and steels structures should be examined for cracks, chips, spalling, or deterioration. Grounding connections should be inspected to insure that they are attached
- The Authorized Inspector should ensure that the exchanger is properly stamped or identified.
- Nozzles should be examined for distortions, cracks, corrosion and other degradation.
- Examinations should be made to determine the header boxes wall thicknesses using Ultrasonic testing. Applicable thickness data should be entered into the facility database.
- If access is provided, examine fan blades and hubs for cracking.



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## INSPECTION PROCEDURE FOR SHELL AND TUBE HEAT EXCHANGERS

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- Examine hold down bolting arrangement-slots should be free of material that would restrict thermal growth.

### Procedure

#### Inspection Intervals

Inspection intervals for Shell and Tube exchangers will be in accordance with pressure vessels as defined in API 510 Vessel Inspection Code, Generally, this means inspection at vessel half remaining life, up to a maximum of ten years. Same Code also provides for extensions based on historical findings.

External Inspection intervals for Shell and Tube Exchangers will be in accordance with pressure vessels as defined in API 510 Vessel Inspection Code. Generally, this interval is 5 years.

#### Internal Inspection

NOTE: The below scopes for Internal and external Inspection should not be considered the limits of inspection. Inspector is responsible for inspecting in accordance with and on the basis of referenced Code Documents.

Internal Inspections should be performed by or under the directions of an Authorized Inspector as defined by Code. An External Inspection should be performed in conjunction with each Internal Inspection.

- The Inspector should examine the internal walls of the shell, channel and nozzles for cracking, pitting, general corrosion and erosion. Indications should be quantified through use of pit depth gages, or ultrasonics (straight or angle beam). Locations and depths should be plotted on an equipment drawing
- Scale buildup or sludge deposits should be noted along with their location on the shell or nozzle.
- All gasket surfaces should be examined for any signs of damage.
- Examine condition of pass partition plate and weldments (typically for cracking) and gasket surfaces for metal loss.
- When the tube bundle is removed from the shell, a visual examination should be done before cleaning noting the amount of scale, sludge and general fouling products. Also, if variations of deposits exist, note locations.

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## INSPECTION PROCEDURE FOR SHELL AND TUBE HEAT EXCHANGERS

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- Baffles and tie-rods should be examined for loose nuts as well as metal loss. Also check for tube OD wear where the pass through baffles.
- Verify proper location of impingement plate and for tube OD erosion in the vicinity of inlet nozzles.
- After the bundle is cleaned, a thorough examination should be performed on tubes, tube ends and tube sheets for pitting, thinning and general corrosion. A representative portion of the above should be measured using appropriate instruments. Data should include ID and OD tube measurements, and pit depths. Findings should be noted on equipment drawing.

### Internal Lining Inspection

- Metallic and nonmetallic linings (e.g. strip and plate linings, overlays, internal coatings, refractory) shall be examined during internal inspections of pressure vessels.
- The inspection scope and methods recommended in API RP 572 for metallic and nonmetallic linings should be followed to assess the condition of the lining and the vessel surface beneath.
- A visual inspection of the accessible internal lining should take place at each internal inspection interval. The lining should be inspected for damage such as separation, bulging, spalling, holes, blisters, cracks, chipping, and erosion.
- If lining damage is detected, representative portions of the internal liner should be removed to assess the condition/effectiveness of the liner and the metal beneath the lining. Alternatively, ultrasonic scanning from the external surface may be used to assess the damage beneath the lining,
- Thermography (IR) is an accepted on-stream inspection method to detect refractory damage. Reference Maintenance Procedure; MNT-INSP-029. Infrared.

### External Inspection

The following items should be included among those items checked during external inspections:

NOTE: It is preferred that an External Inspection Checklist is utilized for recording the results.

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## INSPECTION PROCEDURE FOR SHELL AND TUBE HEAT EXCHANGERS

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- Platforms, ladders, stairways, and their supports, to assure their serviceability.
- Concrete pedestals, foundations, skirt fire proofing should be examined for cracks, chips, spalling, or deterioration. Grounding connections should be inspected to insure that they are attached.
- Paint coating should be examined for blister and chipping that would expose the vessel to corrosive elements. Insulation and metal jacketing should be examined for integrity of sealing and for indications of corrosion under insulation.
- Condition of Data Plates and ID Markings.
- Nozzles should be examined for distortions, cracks, corrosion, and other degradation. Reinforcements should be examined for evidence of leakage. Weep holes should be open.
- Any ancillary equipment such as level bridles, temperature or pressure gauge connections, should be inspected for external corrosion, signs of leakage, and condition of support.
- The Inspector should examine the surfaces of the shells, channel covers, and heads for possible cracks, bulges, and other evidence of deterioration. Attention should be given to support saddles and other external supports.
- Follow-up examinations should be made to determine the shell and channel wall thickness (using Ultrasonic testing) in significant wall loss is observed.

### Repairs and Alterations

- All repairs and alterations performed on shells, channels and heads will be done in accordance with Maintenance Procedure; MNT-INSP-015, Vessel Repair/Alteration Procedure, and in accordance to applicable Codes.
- Repairs to bundles (tube pluggings) or bundle replacements are to be documented by the Inspector in the equipment file. Location of plugged tubes should be mapped on equipment tubesheet drawing along with date plugged.
- All repairs, whether to shell or bundle, are to be approved by the Reliability Authorized Inspector. Maintenance Engineer should be consulted with for repairs not of a routine nature.

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## INSPECTION PROCEDURE FOR SHELL AND TUBE HEAT EXCHANGERS

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- Repair, alteration and bundle replacement documentation is to be kept in the Reliability Equipment Files or Plant Condition Monitoring System (PCMS).

### Nonconformities

- Definition - Any change in the condition of an item described on the original Manufacturer's Data Report (U-1A), NBIC-R1 or API 510 Repair/Alterations Reports that affects the pressure containing capability of the pressure vessel.
- Non-conformance conditions will be reviewed by a designated Technical Team (typically Area Inspector and Area Maintenance Engineer) who will make repair or alteration recommendations in accordance with Maintenance Procedure; MNT-INSP-027, Inspection Recommendation Process, to assure continued integrity and Code compliance.
- Non-conformance issues should be forwarded to Refinery Management if proper resolution is not reached in a timely manner.

### Reports

At a minimum, condition of the following should be indicated on Inspection Report:

1. Recommendations and Repairs Completed during current Maintenance Event.
2. Condition of the following:
  - a. Bundle
    - i. Tubes (ID and OD)
    - ii. Tubesheet (face a, baffle and gasket surfaces)
    - iii. Floating Head (ID and OD, pass partitions, gasket surfaces)
    - iv. Spacers, baffles, impingement plates
  - b. Shell
    - i. Shell Can Section and Body Flanges

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## INSPECTION PROCEDURE FOR SHELL AND TUBE HEAT EXCHANGERS

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- ii. Nozzle Necks and gasket surfaces
- iii. Shell Cover and gasket surfaces
- iv. Small bore Taps
- c. Channel
  - i. Dollar Plate (Channel Cover) and gasket surfaces
  - ii. Pass Partition and gaskets surfaces
  - iii. Nozzle Necks and gasket surfaces

NOTE: External Checklist should be used for External Inspection Topics

### Documentation

Inspection Reports should become a part of the Equipment Items Progressive Inspection Records.

Documentation and results on inspections should be kept in Reliability Equipment Files and/or in Plant Condition Monitoring System Data Base.

**END OF PROCEDURE**

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## Shop Repairs to a Horizontal Barrel Centrifugal Pump

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APPROVED: \_\_\_\_\_ DATE APPROVED: \_\_\_\_\_ DATE EFFECTIVE: \_\_\_\_\_  
Maintenance Manager

**PURPOSE** This Procedure describes the shop repairs of a centrifugal pump (horizontal barrel). This procedure applies to all Maintenance personnel that perform or assist in this work and covers equipment brought into shop for repairs.

**REFERENCES**

- MATERIAL SAFETY DATA SHEETS
- Manufacturer's Service Manual
- MOC Form (if necessary)

**SPECIAL EQUIPMENT** Refer to proper MATERIAL SAFETY DATA SHEETS.

**PREREQUISITE** This procedure requires qualified craftsmen.

1. REVIEW this procedure with Maintenance crews to ENSURE all steps and cautions are clear and all hazards have been DEFINED. Match the proper MATERIAL SAFETY DATA SHEETS with the equipment service.
2. Use special precautions defined on MATERIAL SAFETY DATA SHEETS and verify operation of all safety showers and eyewashes near the work area to ENSURE they are in good working order.
3. Take proper steps to VERIFY that equipment to be worked is properly CLEAN and CLEAR of hazardous material.
4. WEAR proper protective equipment.

**PROCEDURE** SHOP REPAIR TO A HORIZONTAL BARREL CENTRIFUGAL PUMP

1. DISASSEMBLE pump completely. CLEAN all parts.
2. All critical fits such as bearing fit, bearing crush, sleeve fits, housing fits and clearances such as wear rings, throat bushings and bearings will be measured and fall inside the manufacturer's tolerances. REPAIR or REPLACE all necessary parts.
3. All runouts, concentricity, etc., will be checked and fall within the manufacturer's tolerances. REPAIR or REPLACE where needed.
4. Rotors will be balanced to proper tolerances.

Note: Balance Report to be attached to Repair Record.

5. Any part used in a repair will be designed for the intended use and will be CHECKED for dimensional integrity, surface finish or metallurgy.
6. Any material changes must be approved by a MOC Procedure.
7. Shop will VERIFY all water jackets/coolers are CLEANED and TESTED.
8. The Manufacturer's service Manual will be used assuring that the proper repair methods are used in the repair including specification and tolerances based on OEM specifications, industry standards or sound engineering judgment based on equipment history.
9. All pumps must be tested to VERIFY no leakage of seals, gaskets and fittings.
10. The proper repair records will be filled out by the shop making the repairs The facility will maintain records.

Note: Final equipment alignment and piping fit ups will fall within accepted tolerances.

**END**

## CENTRIFUGAL PUMP REPAIR RECORD

Pump #: \_\_\_\_\_ Date: \_\_\_\_\_ WO: \_\_\_\_\_ Unit: \_\_\_\_\_  
Manufacturer: \_\_\_\_\_ RPM: \_\_\_\_\_ Temp: \_\_\_\_\_

1. SHAFT
  - A. Run Out \_\_\_\_\_
  - B. Coupling Fit GOOD \_\_\_\_\_  
BAD \_\_\_\_\_
  - C. Bearing Fit
    - 1) Thrust Bearing No. \_\_\_\_\_  
Int. Fit \_\_\_\_\_
    - 2) Radial Bearing No. \_\_\_\_\_  
Int. Fit \_\_\_\_\_
  - D. Throat Bushing  
Bushings Clearance \_\_\_\_\_ (Max .025)  
Corrective Action \_\_\_\_\_
2. BEARING HOUSING
  - A. Bearing to Housing Fits
    - 1) Thrust Bearing Clearance \_\_\_\_\_
    - 2) Radial Bearing Clearance \_\_\_\_\_
    - 3) Oil Throwers Concentricity \_\_\_\_\_ (Max .002)
  - B. Mic. Boss Fit
    - 1) Bearing Housing \_\_\_\_\_
    - 2) Head \_\_\_\_\_  
Corrective Action \_\_\_\_\_
3. STUFFING BOX HEAD
  - A. Wear Ring Clearance
    - 1) Head Wear Ring \_\_\_\_\_
    - 2) Case Wear Ring \_\_\_\_\_
  - B. Mic. Boss Fit
    - 1) Case Boss Fit \_\_\_\_\_
    - 2) Head Box Fit \_\_\_\_\_  
Corrective Action \_\_\_\_\_
4. Set Thrust \_\_\_\_\_ (Max - Packing: .003-.005 Seal: .001-.003)
5. Shaft Runout on Coup. End \_\_\_\_\_ (Max .002)
6. Shaft Runout on Imp. End \_\_\_\_\_ (Max .002)
7. Shaft Deflection \_\_\_\_\_ (Max .002)
8. Runout from Shaft to Bearing Housing Flange Boss \_\_\_\_\_ (Max .002)
9. Runout from Shaft to Bearing Housing Flange Face \_\_\_\_\_ (Max .002)
10. Runout from Shaft to Head Wear Ring \_\_\_\_\_ (Max .0035)
11. Runout on Imp \_\_\_\_\_ (Max .003)
12. Seal Glang Throat Center to Shaft: Yes \_\_\_\_\_ No \_\_\_\_\_
13. Test Seal at \_\_\_\_\_ lbs. Test with \_\_\_\_\_
14. Date Completed \_\_\_\_\_
15. Completed by \_\_\_\_\_

COMMENTS \_\_\_\_\_  
\_\_\_\_\_



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## Choker, Wire Rope Sling, Metal Mesh Sling, Synthetic Webbing Slings, Natural and Synthetic Fiber Rope & Chain Sling Inspections

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APPROVED: \_\_\_\_\_ DATE APPROVED: \_\_\_\_\_ DATE EFFECTIVE: \_\_\_\_\_  
Maintenance Manager

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**PURPOSE** This Procedure describes the inspections that apply to the integrity of rigging materials.

**AUTHORITY** The Maintenance Supervisor has the responsibility to insure compliance with the terms of this procedure. He further has the authority to intercede, revise and/or initiate additional inspections and/or checkout requirements as may be required to insure all equipment is safe and operable and properly maintained.

**REFERENCES**

- OSHA 1910.184
- ASME B30.9-1990
- ASME B30.9a-1991

**INSPECTION FREQUENCY**

1. Prior to use, the equipment shall be inspected to insure there is no damaged or worn parts and the equipment meets or exceeds the appropriate industry standards. No record is required.
2. A semi-annual inspection shall be done to insure the equipment meets or exceeds the appropriate industry standard. A record of this inspection will be maintained.
3. New, modified or repaired equipment shall be certified by the qualified agency supporting or repairing the equipment. This certification record will be maintained.

**SPECIAL EQUIPMENT** Leather Gloves

**PREREQUISITE** This work requires qualified craftsmen

**PROCEDURE** **WIRE ROPE SLINGS** - The prior to use inspection is a visual examination by the user or other designated personnel with records not required. These visual observations should be concerned with discovering gross damage, such as listed below, which may be an immediate hazard:

1. Distortion of rope in the sling such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion. Loss of rope diameter in short rope lengths or unevenness of outer strands should provide evidence the sling or slings should be replaced.
2. General corrosion.
3. Broken or cut strands.
4. Number, distribution, and type of visible broken wires.

5. Examine internal rope for damage and corrosion.

Semi-annual inspection - This inspection shall include the requirements listed under prior to use inspection and, in addition, the inspection shall be conducted on the entire length of each sling including splices, end attachments, and fittings. Deterioration, which would result in loss of original strength, shall be observed and determination made whether further use of the sling would constitute a hazard.

**REPLACEMENT OF WIRE ROPE SLINGS** - No precise rules can be given for determination of the exact time for replacement of a sling since many variable factors are involved. Continued use in this respect depends upon the judgment of a designated person in evaluating a used sling. Safety of sling operation depends upon this remaining strength.

Conditions such as the following should be sufficient reason for questioning sling safety and for consideration of replacement.

- For strand laid and single part slings ten randomly distributed broken wires in one rope lay, or five broken wires in one strand in one rope lay.
- Severe localized abrasion or scraping.
- Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure;
- Evidence of heat damage.
- End attachments that are cracked, deformed, or worn to the extent that the strength of the sling is substantially affected.
- Hooks should be inspected in accordance with ASME/ANSI B30.10.
- Any corrosion of the rope or end attachments.
- Multi-part removal criteria for cable laid and braided slings.

**METAL MESH SLINGS** - The prior to use inspection is a visual examination by the user or other designated personnel with records not required. It shall be inspected for safe conditions and to insure that the correct sling is being used per ASME B30.9-1990 standards.

Semi-annual inspection - This inspection shall include the requirements listed under prior to use inspection and, in addition:

- Shall have identification giving rated load capacity in basket, choker and vertical hitch.
- A broken weld or a broken brazed joint along the sling edge.
- A broken wire in any part of the mesh.
- Reduction in wire diameter of 25% due to abrasion or 15% due to corrosion.
- Lack of flexibility due to distortion of the mesh.
- Distortion of the choker fitting so the depth of the slot is increased by more than 10%.
- A 15% reduction of the original cross-sectional area of metal at any point around the hook opening of end fitting.
- Visible distortion of either end fitting out of its plane.
- Cracked end fitting.

**REMOVAL CRITERIA OF METAL MESH SLINGS** - If an item listed under semi-annual inspection is found, the sling is to be removed from service.

**SYNTHETIC WEBBING SLINGS** - The prior to use inspection is a visual examination by the user or other designated personnel. It shall be inspected for safe conditions and to insure that the sling is being used per ASME B30.9a-1991 standards.

Semi-annual inspection - A sling shall be removed from service if damage such as the following is visible and shall only be returned to service when approved by a designated person.

- "Red Guard" is showing anywhere along sling.
- Acid or caustic burns.
- Melting or charring of any part of the sling.
- Holes, tears, cuts, or snags.
- Broken or worn stitching in load bearing slices.
- Excessive abrasive wear.
- Knots in any part of the sling.
- Excessive pitting or corrosion, or cracked, distorted, or broken fittings.
- Other visible damage that causes doubt as to the strength of the sling.

**REMOVAL CRITERIA OF SYNTHETIC WEBBING SLINGS** - If an item listed under semi-annual inspection is found, the sling is to be removed from service.

**NATURAL AND SYNTHETIC FIBER ROPE** - The prior to use inspection is a visual examination by the user or other designated personnel with records not required. It shall be inspected for safe conditions and to insure that the correct fiber rope is being used per ASME B30.9-1990 standards.

Semi-annual inspection - This inspection shall include the requirements listed under prior to use inspection and, in addition:

A sling shall be removed from service if damage such as the following is visible and shall only be returned to service when approved by a designated person.

- Shall have identification giving type of material and rated load capacity.
- Cuts, gouges, badly abraded spots.
- Seriously worn surface fibers or yarns.
- Considerable filament or fiber breakage along the line where adjacent strands meet (light fuzzing is acceptable).
- Particles of broken filament or fibers inside the rope between the strands (inspect inside the rope).
- Discoloration or harshness that may mean chemical damage or excessive exposure to sunlight. Inspect filaments or fibers for weakness or brittleness.
- Kinks
- Melting or charring on any part of the sling.
- Excessive pitting or corrosion, or cracked, distorted or broken fittings.
- Other visible damage that causes doubt as to the strength of the sling.

**REMOVAL CRITERIA OF FIBER SLINGS** - If an item listed under semi-annual inspection is found, the sling is to be removed from service.

For additional information refer to ASME B30.9-1990.

**CHAIN SLINGS** - The prior to use inspection is a visual examination by the user or other designated personnel. Check: chain and attachments for wear, nicks, cracks, breaks, gouges, stretch, bends, weld splatter, discoloration from excessive temperature, and throat opening of hooks. Chain links and attachments should hinge freely with adjacent links. Latches on hook, if present, should hinge freely and seat properly without evidence of permanent distortion. Sling shall have tag giving sling length, size and rated load in vertical, basket and choker hitch.

Semi-annual inspection - this inspection shall include the requirements listed under the prior to use inspection and in addition, items such as the following:

Each link and end attachment shall be examined individually, taking care to expose inner link surfaces of the chain and chain attachments to inspect for those items defined in ASME B30.9a-1991.

- Worn links should not exceed values given in Table 2 of ASME B30.9a-1991 or that which is specifically recommended by the manufacturer.
- Sharp transverse nicks and gouges should be rounded out by grinding and the depth of the gouge or rounded out portion should not exceed values given in Table 2 of ASME B30.9a-1991.
- Hooks should be inspected in accordance with ASME/ANSI B30.10.
- If present, latches on hooks should seat properly, rotate freely, and show no permanent distortion.

**REPAIR OF CHAIN SLINGS** - Any hazard condition disclosed by the inspection requirements of ASME B30.9a-1991 shall be corrected before use of the chain or sling is resumed. Repairs shall be made only by the chain manufacturer or qualified personnel.

When repairs are made, the following criteria shall be followed:

- Certification papers to identify the length and load rating.
- Alloy steel chain and coupling links used for repair shall conform to the strength requirements and other requirements of this Standard. Cracked, broken, or bent links shall not be repaired; they shall be replaced.
- When repaired, a sling shall be permanently marked to identify the repairing agency.
- Attachments which are used for repair shall conform to the strength requirements and other requirements of this Standard. Cracked, broken, or bent attachments shall not be repaired; they shall be replaced.
- Mechanical coupling links or carbon steel repair links shall not be used to repair broken lengths of alloy chain.

END

Index & Samples - [www.industrydocs.org](http://www.industrydocs.org)

## Semi-Annual Rigging Material Inspection Record

Equipment Name _____	Size _____
Location _____ I.D.# _____	
Manufacturer's Name _____	
Has certification of proof test been received from manufacturer or repairing agency? <input type="checkbox"/> yes <input type="checkbox"/> no	
Has equipment satisfactory passed operational and rated load test as per ASME B30.2a-1991 paragraphs 2-2.2.1. and 2-2.2.2. (overhead traveling cranes)? <input type="checkbox"/> yes <input type="checkbox"/> no <b>Operational</b> <input type="checkbox"/> yes <input type="checkbox"/> no <b>rated load test</b>	
Inspector's Signature _____	Date _____

CHAINS AND CHAIN SLINGS	WIRE ROPE SLINGS AND CHOKERS	METAL MESH SLINGS
1 Nicks <input type="checkbox"/> yes <input type="checkbox"/> no	1 Kinked <input type="checkbox"/> yes <input type="checkbox"/> no	1 Broken welds <input type="checkbox"/> yes <input type="checkbox"/> no
2 Cracks <input type="checkbox"/> yes <input type="checkbox"/> no	2 Crushed <input type="checkbox"/> yes <input type="checkbox"/> no	2 Broken brazed joints <input type="checkbox"/> yes <input type="checkbox"/> no
3 Breaks <input type="checkbox"/> yes <input type="checkbox"/> no	3 Unstranded <input type="checkbox"/> yes <input type="checkbox"/> no	3 Is sling flexible <input type="checkbox"/> yes <input type="checkbox"/> no
4 Gauges <input type="checkbox"/> yes <input type="checkbox"/> no	4 Birdcages <input type="checkbox"/> yes <input type="checkbox"/> no	4 Stretched end fittings (eyes) <input type="checkbox"/> yes <input type="checkbox"/> no
5 Discoloration from excessive heat <input type="checkbox"/> yes <input type="checkbox"/> no	5 Main strand displacement <input type="checkbox"/> yes <input type="checkbox"/> no	5 Cracked end fittings <input type="checkbox"/> yes <input type="checkbox"/> no
6 Throat opening of hooks <input type="checkbox"/> yes <input type="checkbox"/> no	6 Core protrusion <input type="checkbox"/> yes <input type="checkbox"/> no	
7 Chain links and attachments hinge freely with adjacent links <input type="checkbox"/> yes <input type="checkbox"/> no	7 Corroded <input type="checkbox"/> yes <input type="checkbox"/> no	
8 Safety latches on hook work freely and seat properly <input type="checkbox"/> yes <input type="checkbox"/> no	8 Broken or cut strands <input type="checkbox"/> yes <input type="checkbox"/> no	<b>ANY OTHER EQUIPMENT</b>
9 Excessive wear <input type="checkbox"/> yes <input type="checkbox"/> no	9 Broken wires <input type="checkbox"/> yes <input type="checkbox"/> no	1 Does equipment show excessive wear or damage <input type="checkbox"/> yes <input type="checkbox"/> no
10 Stretch <input type="checkbox"/> yes <input type="checkbox"/> no		
11 Bends <input type="checkbox"/> yes <input type="checkbox"/> no		
12 Weld splatter <input type="checkbox"/> yes <input type="checkbox"/> no		

## Semi-Annual Rigging Material Inspection Record

NATURAL & SYNTHETIC FIBER	SHACKLES, SNATCH-BLOCKS, EYEBOLTS & TROLLEYS (or any other equip)	OVERHEAD TRAVELING CRANES
1 Surface fibers or yarns seriously worn <span style="float: right;">__yes__no</span>	1 For "American-made" shackles does the pin make up so as to protrude through with one thread showing completely <span style="float: right;">__yes__no</span>	1 Are members deformed, cracked or corroded <span style="float: right;">__yes__no</span>
2 Considerable filament or fiber breakage where adjacent strands meet <span style="float: right;">__yes__no</span>	2 Has a substitute been made for shackle-pin (such as a stud bolt, etc) <span style="float: right;">__yes__no</span>	2 Are there any loose or missing bolts, nuts, pins or rivets <span style="float: right;">__yes__no</span>
3 Discoloration due to sun-light or chemical damage <span style="float: right;">__yes__no</span>	3 Has any grinding been done on equipment <span style="float: right;">__yes__no</span>	3 Are there any cracked or worn sheaves or drums <span style="float: right;">__yes__no</span>
4 Kinks or hockles <span style="float: right;">__yes__no</span>	4 Is eyebolt of proper construction with shoulder between thread and eye <span style="float: right;">__yes__no</span>	4 Are there any cracked, worn or distorted parts such as: pins, bearings, wheels, shafts, gears rollers, locking and clamping devices, bumpers and stops <span style="float: right;">__yes__no</span>
5 Melting or charring <span style="float: right;">__yes__no</span>	5 Does snatch block show excessive wear such as sheave groove, or hook to swivel case <span style="float: right;">__yes__no</span>	5 Are function labels in place and legible <span style="float: right;">__yes__no</span>
6 Acid or caustic burns <span style="float: right;">__yes__no</span>	6 Does snatchblock sheave have excess slack (wobble) <span style="float: right;">__yes__no</span>	
7 Holes <span style="float: right;">__yes__no</span>	7 Are snatch block side shields bent or cracked <span style="float: right;">__yes__no</span>	
8 Tears <span style="float: right;">__yes__no</span>	8 Are all fasteners in place and secure, including all snap rings <span style="float: right;">__yes__no</span>	
9 Cuts <span style="float: right;">__yes__no</span>		
10 Snags <span style="float: right;">__yes__no</span>		
11 Broken or worn stitchings <span style="float: right;">__yes__no</span>		
12 Knots <span style="float: right;">__yes__no</span>		