ENERGY & TECHNOLOGY, CORP / ENERGY TECHNOLOGY MFG & THREADING, LLC.

WORK INSTRUCTIONS

TABLE OF CONTENTS

COPY #
*Contact Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC for Registered Copy

Revision History

REV.	Description of change	Effective Date
NEW		2/1/10
Rev. A	Revision of Work Instructions.	7/1/11
Rev. B	Rewrite of Instructions	4-30-12

SECTION 1 – PROCESSING SUMMARY

1.1. SCOPE

1.1.1. Objective

The specifications and work instructions contained herein are to be used for the machining and qualification of threading for API Oil Country Tubular Goods per API spec Q1 and related materials by Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC This work instruction and inherent standard must not be deviated from without written approval or as stated in Section 1.1.2, 1.1.3, and 1.1.4.
If any customer applies this work instruction and implied Standard, on their material, the customer shall approve this Operating Procedure in writing from that particular customer or that Customer's Representative.

1.1.2. Priority

Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC will be producing threads to a referenced design stated by A.P.I. or for a proprietary thread owner.

1.1.3. Regulations

In no case will this work instruction be used or interpreted to transgress any federal, state, or local laws or regulations in effect where it is applied.

1.1.4. Revisions

Revisions or changes, as they apply to this work instruction and included specification, are considered to be improvements. In no case shall revisions be approved which compromise the safety of the persons, equipment, or material involved. In no case shall revisions be approved that sacrifice the quality of inspection performed.

1.2 THREADING AND PRODUCTION FLOW

Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC facilities are designed to process material in a specific order. Due to API specifications, customer preference, or special circumstances, some deviation from this order may be required. Whatever the final order of inspection, the processing material through-put rate must be independent for each phase of process. Each process must stand alone and the time required for its application must not be impacted by pressure from other processes or personnel.

Job processes *with typical activities are as listed below. More specific information is given in the instruction document.*

1.2.1 CNC LATHE (Tubing & Casing)
(Tubing 2 3/8" to 4 1/2")
(Casing 4 1/2" to 20")
Includes Machining Processes

A. Material Verification
B. Verification of *machining* program to thread design drawing
C. Verification of gauges required and calibration status
D. CNC setup
E. Threading of material
F. Visual Inspection
G. Removal of burrs and sharp edges on connection
F. Gauging of elements

1.2.2 QUALITY CONTROL FINAL INSPECTION (Tubing & Casing)
(Tubing 2 3/8" to 4 1/2")
(Casing 4 1/2" to 20")
Includes inspection Processes

A. Gauge setup and verification
B. Creation of Stencil.
C. Material Verification
D. Visual Inspection of machined thread form
E. NDT Gauging of dimensional elements
F. Documentation of element dimensions
G. Buffing of rough edges
H. Material acceptance
I. Identification Marking

1.2.3 BUCK ON UNIT OPERATION (Tubing & Casing)
(Tubing 2 3/8" to 4 1/2")
(Casing 4 1/2" to 20")
Includes Buck On Operation Processes

A. Buck On Unit setup according to size and connection
B. Setup of tools
C. Creation of drift stencil
D. Acquire and verify threading compounds and/or all materials instructed by work order
E. Material Verification

F. Verify coupling make up & torques
G. Visual of threads
H. Application of thread compound under coupling
I. Hand tight installation of couplings
J. Make up of couplings to required torque and position.
K. End drift with appropriate drift measured to have required dimension.
L. Installation of protectors
M. Application of stencil
N. Measurement of material length
O. Documentation of make up data

1.2.3.1 BUCK ON UNIT OPERATION (Tubing & Casing)
(Tubing 2 3/8" to 4 1/2")
(Casing 4 1/2" to 20")
Includes Buck Off Operation Processes

A. Buck On Unit setup according to size and connection
B. Setup of tools
C. Creation of drift stencil
D. Acquire and verify threading compounds and/or all materials instructed by work order
E. Material Verification
F. Verify coupling make up & torque
G. Buck off existing coupling
H. Clean coupling
I. Clean connection
J. Visual inspection of connection and coupling
K. End drift with appropriate drift measured to have required dimension.
L. Application of thread compound
M. Installation of protectors
N. Application of stencil
O. Documentation of break off data
P. Measurement and documentation of material length

1.2.4 SAW OPERATION (Tubing & Casing)
(Tubing 2 3/8" to 4 1/2")
(Casing 4 1/2" to 20")
Includes Service station Processes

A. Band saw setup
B. Stencil creation
C. Material verification
D. Visual inspect connection and/or tube body to verify the reject
E. Recording of mill stencils and traceability markings
F. Saw cut of material
G. Removal of shavings and coolant

H. Reapplication of all stencils and markings
I. Measurement of material length
J. Material Identification Marking
K. Documentation

1.2.5 Final Service (Tubing & Casing)
(Tubing 2 3/8" to 4 1/2")
(Casing 4 1/2" to 20")
Includes Service station Processes

A. Setup of tools
B. Verify and acquire threading compounds and/or all materials instructed by work order
C. Material Verification versus job order.
D. Removal of any debris that may be inside of tube body or on the connection
E. Visual of threads
F. Application of thread compound
G. Applications of protectors
H. Measurement and documentation of material length
I. Material Identification marking
J. Documentation

1.3 THREADING PERSONNEL

Employee Certification at Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC.
(For more information, refer to Qualifications, training program for certification of employees).

1.3.1.5 Quality Control (Thread Inspector)

Thread Inspectors shall have proof of prior experience or on the job training. When a new employee has prior experience the employee shall be tested by gauging of 10 connections 100%. Once the inspector has completed the test the Threading Superintendent must approve the acceptance and certify the employee.

1.3.1.5 Machine Operators

Machine operators shall have proof of prior experience and or on the job training. If a new employee has previous experience he shall be observed and supervised for no less than 10 working days. Once this time period has passed the Threading Superintendent will determine the acceptance of the employee certification.

1.3.1.5 Buck On Unit Operator

Buck on unit operators shall have proof of prior experience and or on the job training. If a new employee has previous experience he shall be observed and supervised for no less than 10 working days. . Once this time period has passed the Threading Superintendent will determine the acceptance of the employee certification.

1.3.1.5 Service Hand

Service hands shall have proof of prior experience and or on the job training. If a new employee has previous experience he shall be observed and supervised for no less than 10 working days. Once this time period has passed the Threading Superintendent will determine the acceptance of the employee certification.

1.4 Threading Equipment

1.4.1 Equipment Calibration

All equipment at Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC requiring calibration is governed by the Quality Management System procedure for Calibration Program. A log of applicable equipment with calibration dates is readily available to the customer on the Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC web-site.

1.4.2 Documents and Equipment List

The following is a list of the items necessary for proper Threading, Quality Control, and traceability of tubular and related materials. The items listed for each area shall be readily available to the personnel working in that area.

1.4.2.5 **CONTROL ROOMS** (Threading & Quality Control)

A. Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC Work Instructions
B. Customer Specification *
C. API Specification STD 5B *
D. API Specification RP 5B1 *
E. API Specification SPEC 5C1*
F. API Specification SPEC 5CT *
G. .750 TPF 5 TPI External Buttress Thread Overlay Per Spec 5B
H. .750 TPF 8 TPI 8 Round Overlay Per Spec 5B
I. Calibration Logs

**All reference documents must be of the latest publication.

1.4.2.5 CNC OPERATOR

A. 12” Scale
B. 12” Dial Caliper
C. Allen Wrenches
D. Q.C. Gauges
E. Calibration Standard (Ring & MRP set standard)
F. Metal Marker
G. Tooling and Inserts
H. Grinder/buffer
I. Coolant Plug

1.4.2.5 QUALITY CONTROL INSPECTOR

A. 12” Dial Calipers
B. 12” Scale
C. MRP Gauge
D. Taper Gauge
E. Thread Height Gauge
F. Lead Gauge
G. Metal Protractor
H. Run Out Gauge
I. Ring Gauge
J. Buffing Grinder
K. Depth Micrometer
L. Profile Gauge
M. Molding Material
N. Stencil Paper
O. Metal Marker
P. White Stencil Ink and/or Spray Paint
Q. Clear Spray paint
R. Red Spray Paint
S. Yellow Tape
T. Grinding Wheels
U. Drift
V. F-7.5.2-1
W. F-7.5.2-2
X. F-7.6-3

1.4.2.4 BUCK ON UNIT OPERATOR

A. 12” Scale
B. Depth Micrometer
C. Metal File
D. Drift
E. Threading Compound application tool

F. Thread Locking Compound
G. Pipe Wrench
H. Stencil Paper
I. White Stencil Ink and/or Spray Paint
J. Clear Spray paint
K. Yellow Tape
L. Metal Marker
M. Tally Tape
N. F-7.5.2-3
O. F-7.5.2-4

1.4.2.5 Service Hand

A. Threading Compound application tool
B. Yellow Tape
C. Pipe Wrench
D. Metal Marker
E. Tally Tape
F. F-7.5.2-4

1.4.2.6 SAW OPERATOR

A. Tally Tape
B. Pipe Wrench
C. Square
D. Coolant Plug
E. Stencil Paper
F. White Stencil Ink and/or Spray Paint
G. Clear Spray paint
H. Yellow Tape
I. Metal Marker
J. Ink Pen
K. F-7.5.2-4 (Tally Sheet)

1.5 MATERIAL IDENTIFICATION, AND VERIFICATION

Material Verification is the first process that takes place in the planning of material flow. All personnel in all areas have the responsibility of verifying the material prior to starting and completing the processes performed on the material.

A. YARD PERSONNEL

Technical Industries Inc. yard personnel are responsible for verifying all material prior to moving and loading on the thread line. No material shall be moved or processed until all of the following verification requirements are met:

a) P.O. number, Work Order number, and/or I.D. number on the material matches the work order;
b) Material class, grade, and weight matches the work order;
c) Joint numbers when applicable;
d) Material piece count matches the work order;
e) Material rack location matches the work order;

In the event that the material does not meet one or more of the verification requirements, all processes shall be discontinued immediately and brought to the Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC representative, for further review. There shall be no movement of material until all discrepancies have been resolved.

Once all the verification requirements have been met, the yard personnel may proceed loading the thread line.

B. THREADING PERSONNEL

Saw Operations, Quality Personnel, Threading Operator, Service Hands

Prior to performing any of the allocated tasks Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC personnel are responsible for verifying all of the following requirements:

a) P.O. number, Work Order number, and/or I.D. number on the material matches the work order;
b) Material size , grade, and weight matches the work order;
c) Material piece count matches the work order;
d) Joint numbers when applicable;
e) Work order instructions coincide with the material (example: If a work order specifies that a reject pin requires it to be saw cut and threaded. Personnel must verify that the material is a pin reject and not a box reject.)
f) Documents that are required for the traceability of material being processed matches the Work Order description.

In the event that any of the material or documents does not meet one or more of the verification requirements, all processes shall be discontinued immediately and brought to the Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC Production Supervisor immediately for further review. All processes will remain discontinued until all discrepancies have been resolved.

Once all the verification requirements have been met, Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC personnel shall continue the production process.

1.5.1 Identification Number

Each piece of material to be serviced shall be assigned an identification number which shall be unique to the individual piece. If identification numbers were previously assigned and applied, these numbers should be used to ensure proper traceability. If material is received with no identification numbers, identification numbers must be assigned in accordance with the Customer specifications.

1.5.2 Identification Markings

The following identification markings shall begin at a minimum of two feet from the mill end of the pipe and or if repaired the stencil shall then be applied at a minimum of two feet from that end. (The preferred method of application is with white spray paint/ink or roller using a one inch stencil.) Refer to Procedure P-7.5.3 AA

A. Manufactures Name
B. API Number
C. Customer Name
D. Customer Purchase Order or Job number
E. Work Order Number
F. Date
G. Size
H. Weight
I. Grade
J. Type of connection
K. Manufacturer
L. Date

Example:

Energy Technology Manufacturing & Threading ISO 11960 5CT xxxxAPI
W.O. 123456 2/16/10
9-5/8" 53.50# P-110 LC
Customer Name P.O. 1234567

Note* the abbreviation E.T.M.T. may be used.

All mill stencils, traceability markings, and any other existing stencils shall be recorded, in the event that the threading process required by the customer or API specifications causes the loss or removal of any mill stencils and/or traceability markings it is the responsibility of the personnel completing the process to document all mill stencils and traceability markings prior to beginning the process so that no information is lost. All stencils and markings will be reapplied to the material.

API Monogram Program Requirements

Documented procedures dictate the following monogram requirements:

A. The application of the monogram, including license number and date of manufacture
B. Immediate removal of the monogram and license number if the product is found to be non-conforming
C. Authority responsible for the applying and removal of the monogram identified in the Quality Management System

1.5.2.1 Drift Stencils

In the case that material requires to be Full Length Drifted (F.L.D.), a stencil shall be applied to the tube body at a minimum of 2 feet from the mill end once the drift has been passed through the tube body and is accepted. The stencil must contain the service performed (F.L.D.), size drift, Energy Technology Manufacturing & Threading initials, and date.

Example:

F.L.D by E.T.M.T
8.500 2/16/10

When the material is required to be end drifted a stencil shall be applied on the tube body at a minimum of 2 feet from the end of the material that has passed the drift test. The stencil must contain End Drift, size of the drift, Date, and the initials of the personnel performing the end drift.

Example:

End Drift 8.500
2/16/10 A.R.

1.5.3 Defect Markings

In addition to the identification listed in Section 1.5.2, reject markings shall be applied to each piece of rejected material. These markings will identify that the materials or connections are unacceptable per API specifications and/or customer specifications. Reject markings shall be placed be hind the threaded connection or defect on pipe. Documentation and cause of reject shall be written on the applicable document. (The practiced method of application is by painting a red band behind rejected or defected area of material with red spray paint.)
In process rework connections should be marked with a type of yellow marking, tape or paint, which will be non-existent after successful repair.

1.5.4 Sorting of Materials

All pieces classified as containing rejected defects are to be immediately identified with the appropriate markings and, as soon as practical, physically segregated from non-rejected materials.

1.5.5 Color Coding

The pipe shall be color-coded as specified by the Customer, Specifications, or according to API specifications.

1.5.6 Shipping and Receiving of Materials and Supplies

All items shall be verified and accounted for, upon receiving any materials or supplies from outside vendors. It is the responsibility of the employee unloading and / or loading to verify: The correct items are on the shipping or receiving receipt, the item counts are correct, and are in the condition which they were promised.

In the event that there are any discrepancies in the verification process the materials the loading and/or unloading shall be put on hold. The Threading Superintendent and/or Production Supervisor shall be notified. Once all discrepancies have been satisfied the process may continue.

1.6 REPORTING RESULTS

1.6.1 Written Report

A Threading Certificate of Conformance shall be submitted to Customers. Report packages are kept by Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC for at least five (5) years, unless specified otherwise by the Customer. The thread data package shall contain the following:

A. Classification: The final classification of all pieces processed, and the name of the governing specification.
B. Marking: The type, color, and location of the classification markings applied to each piece.
C. Identification: Pipe size, weight, grade, and end finish.
D. Defects: Type, location, and severity of defects.
E. Tally Sheets: A copy of the pipe tally sheets.
F. Date: The date the work was performed.
G. Work Order: The Customer purchase order, work order, or job number·
H. Job Number: Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC

I. Responsibility: The signature of Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC, supervisor responsible for the conduct and quality of the process.

1.6.2 Record Keeping

The following information shall be made available to the Customer upon request. All records will be kept by Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC, for a minimum time period covered under the Quality Management System procedure for Control of Records, unless specified otherwise by the Customer shall be kept no longer than the minimum required:

A. Personnel: The name, job classification, and certification of all inspectors, machinists, and buck on operators performing services to the Customers material.
B. Standards: The types used and the date and method in which used
C. Logs: Original inspection logs, buck on/off records.

1.6.3 Customer Requests

The following information will be made available to the Customer upon request. Request should be made prior to the work being performed:

A. Equipment: The type of equipment that shall be used during the process of the customer's material
B. Methods: The basic type of methods used
C. Photographs: Any unusual damage or defects can be documented with photographs

1.7 MATERIAL HANDLING

1.7.1 Loading and unloading

All loading and unloading shall be performed in a safe manner. Material must be handled carefully to insure that none of the pieces involved are dented, bent, or damaged by any of these processes. Particular care must be taken to avoid dropping and banging of the material. No material shall fall or be dropped over a vertical distance of more than one pipe diameter or six inches, whichever is less.

1.7.2 Rolling

Movement of pipe must be controlled at all times. Avoid hard contact with any type of stops or lifts. Pipe must be rolled along the pipe racks by hand, gently, to minimize pipe-to-pipe impacts. Wrenches, metal pry-bars, and other types of levers may be used to roll pipe along the pipe racks. Special attention must be given to the pin threads when protectors are not securely in place. Threads shall have protectors in place whenever possible.

1.8 REFERENCE PUBLICATIONS

The following reference documents shall be available on location at all times. All personnel shall have ample knowledge of the reference documents that pertain to the process or activity that they perform.

A. Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC W.I.
B. Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC QMS & Procedures.
C. Customer Specification *
D. API Specification STD 5B *
E. API Specification RP 5B1 *
F. API Specification SPEC 5CT *

* All reference documents should be of the latest publication.

SECTION 2- PRE-THREADING REQUIREMENTS

2.1 INITIAL DELIVERY ACCEPTANCE PROCEDURE

Upon delivery of oilfield tubular goods to the threading facility the following shall be verified against the work order accompanying the pipe.

A. Joint count
B. Size
C. Weight
D. Grade
E. Range
F. Connections
G. Presence of box and pin end protectors
H. Seamless or ERW
I. Manufacturer
J. New or used
K. General pipe condition (See 2.3.1)
L. Previous inspection markings

This information must be completely congruent with the information on the Work Order Process Router, F-7.5.1-2. In the event of any discrepancy, the tubular goods are not to be accepted for processing until the Threading Superintendent and or Production Supervisor has been notified and/or authorized by the Customer. Once the Threading Superintendent or his designate has authorized the material, the process shall continue.

2.2 EQUIPMENT PREPARATION

The availability and proper working order (if applicable) should be verified on all the equipment listed in Section 1.4.2 of this document. All inspection equipment used must be verified to be within the proper calibration dates. (See Section 1.4.1 Equipment Calibration).
Any gauge used for evaluation of product conformity shall be recorded on the Gauge Verification form, F-7.6-3.
Measured drift dimensions shall be recorded on F-8.4.5-13.

2.2.1 Electronics

All electronic equipment will be energized to insure a proper warm up time has occurred prior to the beginning of any calibration, threading, or inspection procedures. Proper warm up time must be a minimum of thirty (30) minutes.

2.2.2 Mechanical

Mechanical gauges (i.e., micrometers or calipers, depth gauges, metal rulers, and drift mandrels) must be exposed to the same operating temperature, thirty (30) minutes prior to their use, to enable them to stabilize their temperature to the prevailing ambient or operating temperature.

2.3 THREADING PREPARATION (MATERIAL)

2.3.1 Visual

Pipe or related material must be reasonably clean for processing purposes. The pipe or related material must be visually inspected for excessive amounts of grease, oil, rust or mill coating. It must be verified that all protectors are in place (if applicable) and also noted if there is any signs of handling damage, such as excessive damage to protectors, gouges, dents, etc. Any of these items listed or any other that is unusual or out of the ordinary shall be brought to the attention of the Customer or Customer representative prior to inspection.
Missing protectors, and all other observed damage should be recorded on inventory form, F-7.5.3-3.

2.3.2 Thread Protectors

Thread protectors are in place to prevent any damages occurring on the connections and to keep debris and water out of the tube body. Pipe is to be processed in a single layer format. Use extreme care while handling pipe with thread protectors removed.

2.3.2.1 Removal of Thread Protector

Thread protectors can have sharp edges, metal splinters, and burrs. Gloves and/or extreme care shall be used while handling thread protectors. After removal, thread protectors shall be stacked off the ground. Protectors shall be stacked neatly, away from walking areas. (Protectors are easier to clean if they can be presoaked, in Varsol.)

Thread protectors are to be removed by hand, when possible, or with appropriate strap wrenches, mechanical wrenches, or other devises deemed necessary. **Extreme care must be taken to prevent damage to both ends of threaded connections while removing thread protectors**.

Missing, cross-threaded, and/or stuck protectors must be noted and recorded by the Threading Superintendent or his designate and reported in the final inspection report. This report must include exactly what attempts were made and the results of the process.

2.3.2.2 Cleaning

With a brush and Varsol or equivalent, thoroughly clean the thread protectors and/or couplings. Remove all thread compound, storage compound, grease, oil, dirt and debris from the threaded areas of the thread protectors. While cleaning, visually inspect the thread protectors for damaged thread protector housings and/or threads. Visually examine the thread protector threads for burrs, metal filings and corrosion. Damaged thread protectors shall be set aside. The Threading Superintendent or his designate must re-inspect and visually examine these thread protectors to determine which ones are to be accepted and which ones are to be rejected. The Inspection Manager or his designate must report rejected thread protectors in the final inspection report.

VARSOL IS FLAMABLE!!
Do not smoke in areas where Varsol is in use! Use extreme caution when operating electrical equipment in areas where Varsol is in use! Make sure that there is adequate ventilation in areas where Varsol is in use!

VARSOL IS CAUSTIC!!
Prolonged exposure of the skin to Varsol can result in serious burns! Minimize exposure of the skin by wearing rubber gloves and/or by working quickly and intelligently! Minimize exposure of the eyes to Varsol by wearing goggles or safety glasses and/or by working safely and intelligently! Immediately report all accidental burns to the Threading Superintendent on site.

2.3.2.3 Storage

After the thread protectors are thoroughly cleaned, stack them off the ground in a clean area where they will not be exposed to dirt, magnetic particles, or other debris. Protectors shall be stacked neatly, away from walking areas. Thread Protectors must be completely dry before reinstalling.

SECTION 3 - DRIFT TESTING

3.1 MATERIAL

The drift mandrel shall be made from steel, plastic or hardwood. For CRA material the drift mandrel must be made from plastic (such as Teflon, Nylon, PVC, etc.) or hardwood.

3.2 SHAPE

The drift mandrel shall be cylindrical in shape and may have attachments on one or both ends. Disk and barbell-shaped mandrels shall not be used. The leading edge of the drift shall be tapered or rounded to provide easy entry into the pipe.

3.3 DIMENSIONS

The drift mandrel diameter and length shall be in accordance with Section 6 of API Specification 5CT unless otherwise stated by the Customer or Customer Representative. The drift mandrel and measuring device must be exposed to the same operating temperature, thirty (30) minutes prior to their use, to enable them to stabilize their temperature to the prevailing ambient or operating temperature.

3.3.1 MEASURING DEVICE

The measuring device used for the outside diameter shall be a micrometer, dial gauge, or vernier caliper capable of measuring the drift mandrel with an accuracy of 0.001 inch. The measuring device used for measuring the length of the drift mandrel shall be a steel tape or rule with 1/16 inch increments. The measuring device shall be calibrated on a schedule not to exceed four months.

3.3.2 MEASUREMENT READINGS

The outside diameter of the drift mandrel shall be measured at both ends and the midpoint. A minimum be of two (2) measurements, 90° apart, shall be taken at these three (3) points. The length of the drift mandrel shall be measured from behind both of the tapered or rounded ends. The drift mandrel must be measured at the beginning and end of each workday.
All dimensional data shall be recorded on form F-8.4.5-13.

3.3.3 TOLERANCE

The tolerance allowed on the API specified drift diameter shall be as stated in API 5A5. If a drift mandrel is found to be out of tolerance, all pieces tested since the last good check shall be re-drifted. This is control of non-conforming material.

3.4 PIPE CONDITION

Prior to any drift testing, the pipe must be cleaned and free of any debris inside the tube. The pipe shall be properly supported to prevent any sagging.

3.5 FULL LENGTH DRIFT

In the case that a customer requires the pipe to be full length drifted, the full length drift process shall be carried out prior to threading, ensuring straightness and no damage prior to ETMT processes. The drift mandrel shall be inserted and removed carefully to prevent the drift or threads areas from being scratched or damaged in any way. The drift mandrel shall pass freely through the length of pipe. The maximum allowable force to be exerted on the drift mandrel shall not exceed the total weight of the mandrel. If the drift does not pass through the entire length of pipe, remove and clean both the mandrel and the pipe. Check the pipe for sagging and provide additional support, if necessary. Attempt the drift test again from the other end of the pipe. If the drift mandrel does not pass through the entire length on the second attempt, the length is considered a reject and must be marked immediately as a "No Drift plus a red band" The red bands will be marked, located, and represent where the drift would not pass through the material.

3.6 END DRIFT

Each coupling connection shall be end drifted after buck-on at a 100% frequency. Assuring that the I.D. of the tube that is to be drifted is clear and free of any debris, carefully insert the drift in the I.D. from the coupling end. Care shall be taken to prevent any damages to the thread connection. Pushing the drift to a depth in the tube equal to the back up tong marks on the tube body, only using force equal or less than the weight of the drift. Using caution, pull and remove the drift from the I.D., while preventing any damage to the threaded connection.

If the drift passes freely through the required drift length, the threaded and coupled connections will be considered acceptable and shall be stenciled “End Drifted”.

If the drift does not pass freely through the required drift length or stops due to any obstruction it shall be considered a reject and marked with yellow tape for un-bucking.

SECTION 4- VISUAL AND DIMENSIONAL REQUIREMENTS

4.1 Scope

This work instruction sets forth the requirements or descriptions for visible lighting, mechanical equipment and the procedures for visual and visual thread inspection of OCTG.

4.2 Referenced Documents

API 5B Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads
API RP5B1 Recommend Practice for Gauging and Inspection of Casing, Tubing, and Line Pipe Threads
API 5CT Specification for Casing and Tubing
Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC Qualification and Training Manual
Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC Equipment Calibration Program

4.3 Personnel Qualification

All personnel performing work within this work instruction shall have a qualification level that has satisfied the requirements of the *Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC.* Qualification and Training Program.
All personnel shall have passed the Visual Acuity and Color Contrast eye examination of the program.

4.4 Equipment

4.4.1 Lighting for Inspection

4.4.1.1 Adequate illumination must be provided in the area of visual inspection. Direct daylight conditions do not require additional lighting sources.
Facility and night light levels at the surfaces of materials to be inspected must be at a minimum of 50 foot candles. Proper illumination shall be checked every 4 months and recorded in a log book. The date, name of person checking and the reading shall be recorded.
Night lighting with portable equipment shall have the same requirement, 50 foot candle, and shall be verified prior to job start.
Light meters used to verify illumination shall be calibrated according to the ETMT Equipment Calibration Program and shall be for 1 year maximum.

4.4.1.2 Mirrors used for internal surface illumination shall be non-tinted and have a non-distorted image. The reflecting surface shall be flat and clean.

4.4.2 Gauges

4.4.2.1 Calipers (micrometer, vernier & dial caliper) shall be calibrated using the guidelines of E.T.T. Calibration Program every 4 months. The calibration shall be recorded in the log book and be affixed to the instrument in some form. Instruments shall be verified as accurate through-out the operating range of the instrument. They shall be kept in good condition and not exhibit any sticking or hesitation of movement during its use.

4.4.2.2 Length and diameter measuring devices (steel rules, steel length or diameter tapes and any other non-adjustable measuring devices) shall be verified to have its markings legible and its fixed reference points in good condition. The verification should be documented on a fixed time interval.

4.4.2.3 Depth Gauges shall be verified to be accurate through-out the operating range of its usage. This verification shall be documented and recorded on a log book and affixed to the gauge. This should be verified every 4 months and shall have accuracy within .001" of actual depth of a reference standard.
The gauge shall always be zeroed on a flat surface prior to use.
The base anvil shall always be in a locked position and perpendicular to the travel of depth shaft.

4.5 Visual Examinations

4.5.1 Outside diameter verification may be requested by the customer or Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC to assure compliance with the relevant material specification. This may be accomplished by the use of the following equipment.

- O.D. micrometers are used to determine min. and max.
- Diameter Micrometers or mechanical calipers will be used to measure actual diameter. The gauge must be able to read in thousands of an inch.

4.5.2 Straightness is a visual examination to determine if material is bowed or has hooked ends.

- Pipe to be examined shall be placed on rack that will allow full rotation of the joint several times in this examination.
- Locate area of deviation by observation and position it in a plane that is best for evaluation.
- Using a straightedge of 6' length min. or a taut string (wire) lay it across the plane of the material and measure the deviation with a steel scale or rule.
- Measurement for bowed pipe shall be from end to end.
- Measurement for hooked ends shall be from the tube toward the suspected deviation.
- Deviation shall be evaluated by the relevant material specification in API 5CT

Bowed or hooked ends may cause black threads, wavy threads, and/ovality rejects. In the event that the visual examination determines that the cause of rejects are due to hooked ends, the customer must be informed and additional actions may be taken based upon the customers needs.

4.5.3 Visual Thread inspections are performed on threaded pipe ends and include the coupling if attached. The method is used to locate thread imperfections without using magnetic particle inspection or thread gauges other than a profile gauge.

4.5.3.1 Equipment needed to perform this inspection is:

- Steel scale for determining the LC area on pins and the Perfect Thread Length [1/2NL-(J+1P)] on the internal threads.
- Mirror for inspection of load flanks and roots of internal threads.
- Bright light for inspection of the internal threads.
- Profile gauge
- Flexible steel measuring tape for measuring circumference for non-full crested or black crested thread length
- Thread Pik

4.5.3.2 All thread protectors shall be removed, cleaned and stacked away from the inspection area. Pipe shall not be moved without protectors applied to the threaded connections.

4.5.3.3 All threads will be cleaned thoroughly ensuring that no thread compound, dirt or cleaning material remains on the threads.

4.5.3.4 Determine the LC length of the pin and record the dimension.

4.5.3.5 Determine the Perfect Thread Length (PTL) and record.

4.5.3.6 Slowly roll the individual lengths at least one full revolution while examining the threads.

4.5.3.7 Inspect for imperfections on the face, chamfer, LC area, Non-LC area of the external threads. Apply the thread profile gauge to detect machining errors.

4.5.3.8 On Buttress threads the triangle stamp location shall be verified on the field end. The stamp shall be present and at a distance of A1±1/32”.

4.5.3.9 For internal threads inspect for imperfections in the counter bore, PTL, and threaded area beyond the PTL. Seal ring grooves shall be inspected for any imperfections on each side of the groove. The thread profile shall be applied to the threads to detect

machining errors. Care should be taken not to damage the coupling coating during examinations.

4.5.3.10 Coupling Make up position shall be checked on Buttress threads by observation of the end of the coupling in reference to the triangle stamp location. The coupling end should be located between the base and the apex of the triangle. If it does not verify make up location by measuring distance N-A4, +.200"/-.375".

4.5.3.11 For round thread coupling make up position shall be measured and comply with dimension N-L4 ± .250".

4.5.3.12 Imperfection categories can be found in API 5A5, 5B and 5B1 and related dimensional evaluation categories.

4.5.4 Visual of Pipe Ends

- Each length is visually inspected on the outside surfaced for a distance no less than 18" from the end of the pipe for detection of visible imperfections.
- Upset products shall be inspected for the distance of the upset including run out interval.
- All imperfections detected shall be marked for evaluation.

4.6 Classification of Imperfections.

All imperfections detected and marked for evaluation shall have their disposition determined by the relevant specification.

- Pipe Body imperfections will be evaluated by the current API specification 5CT or customer specification.
- Thread imperfections shall be evaluated based on API 5B or customer specification.

4.7 Reporting and Marking

All precision tools used for location and evaluation of material shall be listed with current calibration information. Form F-7.6-3.

All material that is acceptable shall be stenciled and tallied. All other material if reject shall be painted red and any repairable shall be painted yellow. Customer specification can be used in place of this arrangement.

A summary report (F-7.5.3-4/F-7.5.3-5) shall be completed stating:

- customer,
- services rendered, and date of service
- specification for classification used,
- total acceptable pieces and footage,

- total non-acceptable, reason for non-acceptance and footage (F-7.5.3-4)
- total repairable, defect location and footage (F-7.5.3-4)
- Inspector name

SECTION 5 – CNC OPERATIONS

5.1 Scope

This work instruction covers the operations of the CNC lathe and process taken to achieve Quality Threaded Products with precision and efficiency.

5.1.1 Personnel

Only qualified personnel that has been trained and approved by the Threading Superintendent shall be allowed to operate a CNC lathe.

5.1.2 MATERIALS

A. 12” Scale
B. 12” Dial Caliper
C. Allen Wrenches
D. Q.C. Gauges
E. Calibration Standard (Ring & MRP set standard)
F. Metal Marker
G. Tooling and Inserts

5.1.3 EQUIPMENT AND SETUP

Once the threading operator has received an approved copy of the Work Order Process Router F-7.5.1-2 and the order is ready to be processed, the operator shall verify the material according to 1.5. If there are any discrepancies the inspector must stop and inform the Production Supervisor or Threading Superintendent. The process shall be placed on hold until all the discrepancies have been resolved. Once the material is verified and satisfies section 1.5, the operator may continue the setup process. Setups will be determined by the work order instructions. The following steps are to be followed but not limited to:

a) Uploading or recalling the correct program by verifying the connection, diameter, and weight to the work order.
b) determining the size and setting the chuck jaws accordingly and verifying that the jaws are in the power stroke
c) determining the correct tooling to be used by verifying the connection and tool data in program or instructed by the Production Supervisor or Threading Superintendent
d) Adjusting the handling tables and steady rests level and according to the size and weight of the materials.
e) Obtaining the correct threading inserts by verifying them to the program;

f) Determining the correct measuring instruments needed to set the tool positioning.

g) inserting the material in the machine and double checking the stroke of the chucks so that it will be in its power stroke;
h) Verifying the alignment of all handling equipment

Once these steps have been verified the operator may continue to the final step of zeroing in on the part. When the operator has the first part machined and ready for gauging, it is the operator's responsibility to verify the gauges are zeroed to the correct setting standards. **The first machined part is the operator's responsibility to verify that all dimensions are on size and correct by verifying them to the Q.C. run sheet, or customers part drawing. Once all the dimensions have been verified the operator will kick the pipe out to the inspection area for Q.C. personnel for verification and documentation.**

.

Once the setup process as been completed and the first connection's elements have been verified by the Q.C. Inspector, the CNC operator will be considered to be in production mode. The operator, will then hold tolerances, maintain production, and quality objectives. These objectives are maintained through working efficiently and communicating with the Q.C. inspector.

A record of all down time, problems with threading encountered, pieces threaded-accepted and rejected, shall be maintained on an hour by hour log sheet.

SECTION 6 – THREADING QUALITY CONTROL PROCESS

6.1.1 Scope

This procedure covers the Quality Control processes needed to obtain a company wide goal of providing the industry with Quality and efficiency.

6.1.2 Objective

This document is intended to be used as a minimum requirement, while specifically recognizing 8 round and buttress threads, thread gauges and gauging practice for internal and external threads on casing and tubing.

6.1.3 Materials

A. 12” Dial Calipers
B. 12” Scale
C. MRP Gauge
D. Taper Gauge
E. Thread Height Gauge
F. Lead Gauge
G. Metal Protractor
H. Run Out Gauge
I. Ring Gauge
J. Air Grinder
K. Depth Micrometer
L. Profile Gauge
M. Ink Pen
N. Molding Material
O. 5mm Pencil
P. Stencil Paper
Q. Metal Marker
R. White Stencil Ink and/or Spray Paint
S. Clear Spray paint
T. Red Spray Paint
U. Yellow Tape
V. Grinding Wheels
W. Drift
X. F-7.5.2-1 Buttress thread data
Y. F-7.5.2-2 Round thread data
Z. F-7.6-3 Gauge Verification Form

Materials will vary according to API and job specifications.

6.1.4 Equipment and Setup

When the Quality Control Inspector has received an approved the approved process router 7.5.1-2 the following processes must be followed:

a) obtain and setup all gauges and standards according to connection, size, weight of material and or to customers requirements; Record on form 7.6-3
b) create a stencil with all the necessary information for traceability and material identification as stated in 1.5.2
c) obtain and fill out run sheets according to weight, size, grade, and connection
d) obtain all materials needed to complete the job and or required, documented, and instructed by the work order process router (example: markers, stencil ink, run sheets)
e) all gauges will be checked for calibration dates, setup, zeroed on standards, and ready for use by the CNC operator prior to the completion of the CNC set-up when and where applicable

Once the material has been completed by the threading operator and is received for inspection process, the inspector must verify the material according to 1.5.1, 1.5.2, 1.5.4, 1.5.5. If there are any discrepancies the inspector must stop and inform Production Supervisor or Threading Superintendent. The process shall be placed on hold until all the discrepancies have been resolved.

6.2 Gauging and documentation Intervals

Gauging of elements are set intervals practiced by Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC Gauging intervals may altered at a higher frequency of intervals but shall not compromise Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC minimum frequency of intervals.

At the start up of every job, shift, or the **first 5 threaded** connections shall have each element gauged and documented 100%. Excluding ring gauge or plug, elements shall be checked and documented only on the first threaded connection after the initial setup and the first joint at the beginning of each shift. After the first 5 joints the following frequencies shall be followed:

Element Measured	Measurement Frequency	Document Readings
Pitch Diameter/Ovality	100%	100%
Thread Profile	100%	100%
Visual Inspection	100%	100%
Thread Length L4	100%	10%
Thread Height	20%	20%
Thread Lead	20%	20%
Cumulative Lead	20%	20%
Thread Taper	20%	20%

Chamfer	10%	10%
A1	10%	10%
Thread Run Out	10%	10%
Ring Gauge	Beginning/End Shift	Whenever used

6.2 Acceptance Criteria and final Inspection process

The criteria for acceptance or rejection of material shall follow specifications listed in API 5B for threads and API 5CT for couplings.

After verification of material the inspector may proceed to check and verify the part according to API specification or as required by the customer. Once the part has been determined to meet the acceptance or reject criteria in accordance with API 5B and/or section 1.3 of Threading Work Instructions, the part shall be processed as follows:

A. If the part is acceptable the following steps shall be taken:
   1. Communication of elements with CNC operator
   2. Documentation of elements gauged
   3. Grinding or buffing of rough edges
   4. Material Marking for identification and traceability
   5. Installation of protectors when applicable

B. If the part does not meet API or Customer specifications, it will be considered reject and these steps shall be taken:
   1. Communication of reject elements with CNC Operator to prevent excessive rejects
   2. Documentation of elements
   3. Application of red band behind connection

After (A) and/or (B) have been satisfied the Q.C. Inspector shall move the material down the line, so that it may be processed to its respective area. (Buck on Unit area, Finishing area, or Saw Operations area)

SECTION 7 – BUCK ON UNIT MAKE & BREAK OPERATIONS

7.1 SCOPE

This work instruction covers the buck on unit operations and process taken to achieve Quality Products to API or Customer specifications.

7.1.1 Personnel

Only qualified personnel that has been trained and approved by the Threading Superintendent shall be allowed to operate a Buck on Unit.

7.1.2 MATERIALS

A. 12” Scale
B. Depth Micrometer
C. Metal File
D. Drift
E. Threading Compound application tool
F. Pipe Wrench
G. Stencil Board
H. Coupling Strap wrench
I. White Stencil Ink and/or Spray Paint
J. Clear Spray paint
K. Yellow Tape
L. Metal Marker
M. Form F-7.5.2-3 Torque & Tally

7.1.3 EQUIPMENT AND SETUP

Once the Buck on Unit Operator has received an approved copy of the Process Router and is ready to be processed, the assigned operator shall verify the material according to 1.5. If there are any discrepancies the operator must stop and inform the Production Supervisor or Threading Superintendent. The process shall be placed on hold until all the discrepancies have been resolved. Once the material is verified and satisfies section 1.5, the operator may continue the setup process. Setups will be determined by the Process Router instructions. The following steps are to be followed:

.

A. Verify threading compounds and/or all materials instructed by Process Router
B. create a stencil with all the necessary information for traceability and material identification as stated in 1.5.2.1
C. determining the size and set the inserts on tongs for bucking unit accordingly

7.1.3 EQUIPMENT AND SETUP (continued)

D. Marking the measuring instrument to the correct measuring stand off needed for coupling make up
E. Adjusting the Bucking Unit height according to the size of material
F. Insert the material in to the bucking unit and clamping the tongs down on the O.D. to verify that all tongs are evenly clamping down on the material

7.2 MAKE UP AND BREAK OF COUPLINGS

7.2.1 COUPLING MAKE UP

Once the setup is complete the Bucking Unit Operator may continue to the final steps of the process. The following steps shall be taken.

A. Apply an even amount of thread compound on the entire pin connection that will have the coupling installed or on the coupling threads that will engage the pin. Thread lube inside the coupling is the preference.
B. Stab the coupling on to the pin connection and tighten the couplings hand tight. This is achieved by using a strap wrench and/or using hands to turn the coupling.
C. Position the material in the bucking unit so that the front tongs, when closed land in the center of the coupling
D. Clamp down back up tongs
E. Clamp and turn front tongs at a maximum of 25 rpm to begin the torque and positioning of coupling.
F. Insert and hold measuring instrument used for verifying the make up position on the face of the pin while measuring the distance from the face of the coupling, and observing the dimension.
G. Once the coupling stand off has been satisfied according to API 5CT, 5B1 or customer specifications the torque turns shall be stopped
H. End drift the connection past back up tongs
I. Apply threading compound to exposed threads on inside of coupling
J. Install protector
K. Apply End Drift stencil according to 1.5.2.1
L. Document makeup dimension using document F-7.5.2.3

Once the coupling has been torque to position the operator must then determine if the connection is acceptable or unacceptable according to API 5CT, 5B1 or customer specifications. If the connection is acceptable it may be processed down the line to the final service area. If the make up is considered a reject it will be flagged with yellow tape and set to the side for break and remake

Make up on 8 round will be torque turned to the last scratch (L4) with a tolerance of +/- one thread pitch. Acceptable measurement is based on NL-L4.

Make up of buttress connections will be torque turned on thread pitch at a minimum the base of the apex and a maximum of torque turns to the apex.

7.2.2 Torque Values-When Using Torque Gauge

When buttress connections are being processed, the first 10 joints that are bucked on will be recorded and used to determine the average torque values for the order. The operator will:

a. add the first 10 torque values
b. take the sum of the first 10 torque values and divide it by 10, this value will be considered the optimal torque
c. take the optimal torque and multiply it by .75, this value will be considered minimum torque
d. take the optimal torque value and divide it by 1.25, this value will be the maximum torque

For 8 round connections the torque values are determined by the recommended torque values of API 5C1. The optimal recommended torque values are listed in API 5C1. Once the operator has determined the optimal torque value based up the material, 7.2.2 C and D will be followed.

7.2.3 Coupling Break Off

In the event that couplings need to be removed from the pin ends, the following steps shall be taken with to prevent any damaging of the connections and/or couplings:

A. Set up bucking unit according to section 7.1.3 of this W.I.
B. Remove existing protector
C. place connection in the bucking unit and clamp front tongs in the middle of the coupling
D. back the coupling off using the break out lever on the Bucking Unit, turning the tongs no more than 4 rpm
E. once the coupling has rotated 1-2 full turns release the back tongs and re-clamp, this will relieve any strain on the connection and will help prevent damage
F. back the coupling off until it is loose enough to unscrew by hand
G. unscrew coupling by hand and remove coupling from pin

H. coupling and joint should be marked to identify the correct and original couplings is bucked on the original connection
I. thread compound and all other debris shall be cleaned from the pin connection and the coupling
J. visual inspection of pin threads and couplings to verify no damage was created during the break out of the coupling

Once the coupling has been bucked off, coupling and pin connection cleaned, visual inspection of coupling, and visual inspection of pin connection, the operator may continue to the coupling make up process as stated in 7.2.

It is imperative that the Buck on Unit Operator maintains identification of couplings that are bucked off, and that the correct couplings are matched with the correct pin connection on the remake process. This is obtained through marking the joint number on the couplings and or any other means necessary to maintain traceability.

Once all steps of the buck on process have been satisfied the operator shall move the connection to the finishing area for the final stages of the threading process.

A connection may only have make-up a maximum of three times. If the connection is still unacceptable after the third make up attempt, the connection and coupling is considered reject. The couplings must be bucked off and marked with a red band to identify it as a reject. The threaded connection must be marked with a red band, saw cut and re-machined.

SECTION 8 – SAW OPERATIONS

8.1 SCOPE

This work instruction covers the saw operations and process taken to achieve Quality Products to API or Customer specifications with efficiency.

8.2 Personnel

Only qualified personnel that has been trained and approved by the Threading Superintendent shall be allowed to operate a Buck on Unit.

8.3 MATERIALS

A. Tally Tape
B. Pipe Wrench
C. Square
D. Coolant Plug
E. Stencil Board
F. White Stencil Ink and/or Spray Paint
G. Clear Spray Paint
H. Yellow Tape
I. Metal Marker
J. Ink Pen
K. Form F-7.2.4

8.4 EQUIPMENT AND SETUP

Once the Saw Operator has received an approved copy of the WO Process Router F7.5.1-2 the assigned operator shall verify the material according to 1.5. If there are any discrepancies the operator must stop and inform the Production Supervisor or Threading Superintendent. The process shall be placed on hold until all the discrepancies have been resolved. Once the material is verified and satisfies section 1.5, the operator may continue the setup process. Setups will be determined by the work order instructions. The following steps are to be followed:

A. Verify tools relevant to completing the job
B. Adjust blade guides according to the size of the material to be saw cut
C. Adjust the feed rate and blade speed
D. Adjust Coolant lines and pressure
E. Recording of mill stencils and traceability markings according to 1.5.2
F. Create all stencils required by 1.5.2

Once setup process 8.3 has been satisfied the operator shall continue to the final process of saw cutting the material. The operator must never cut any API casing shorter than 34 feet, unless other wise stated and/or instructed by a work order or Production Supervisor. Any materials that are being saw cut due to production rejects or mill defects, which would ultimately fall under 34 feet, will be flagged and set aside for disposition or feedback from the customer approving the material to be processed.

8.5 Saw Cutting

The following steps shall be followed on each connection that is to be saw cut:

A. If applicable remove any existing protectors from the end being saw cut
B. Insert the coolant plug in the ID of the material, behind the area of where the saw blade will cut. This is to prevent any access coolant leaking inside the material.
C. Saw cut the material using the correct feed and speed
D. While the material is being saw cut the operator must always verify that the blade has a consistent steady flow of coolant to prevent any premature blade wear.
E. Once the end has been saw cut the access material (cut off) should be thrown in the proper cut off container or as stated by the customer on the work order
F. All shavings and coolant shall be moved from the material. In any case that the coolant is inside of the id of the material is must be blown out and free of all debris before final tally
G. Apply stencils and markings according to 1.5.2
H. Install protectors when applicable
I. Tally the materials when applicable and/or stated by the customer.
J. Using form F-7.5.2-4 to document final tally if no other process is required.

Once the material has been through the saw operations process, the material should be processed to the next area according to the steps listed on the router.

SECTION 9 - THREAD GAGING

9.1 SCOPE

9.1.1 Objective

Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC utilizes this standard operating procedure, covering the specified criteria of API thread inspection. This document is intended to be used as a minimum requirement, specifically recognizing eight (8) round and Buttress threads, threads gauges and gauging practice for internal and/or external threads on casing and tubing.

9.1.2 Personnel

Only qualified personnel that has been trained, certified, and approved by the Threading Superintendent shall be allowed the gauging of threads.

9.2 Applicable Specifications

API Std. 5B includes thread gauge procedures and tolerances for Buttress, Eight (8) round, Ten (10) round, 11-1/2 v and Extreme Line threads. However, this SOP outlines only Eight (8) round and Buttress since they are the most common thread form used on oil country casing and tubing.

Information, excerpts and procedures specified herein complies with standards and specifications outlined in the following API manuals:

API STD 5B

API RP5A5

API RP5B1

API RP5CT

9.3 PRE-INSPECTION GUIDELINES

9.3.1 Temperature

Dial Gauges used in performing any thread inspection should be exposed to the exact temperature conditions as the product being inspected. The exposure time may vary, but should be a minimum of 30 minutes prior to the inspection in order to eliminate any and all temperature differences.

9.3.2 Calibration

Dial gauges used for the inspection of threads are "Precision Instruments". The handling, care, and maintenance of these delicate instruments are of the utmost importance and are to be handled only by a qualified thread inspector. The care applied in the every day use of each gauging instrument assures "well defined" and desired thread inspection results.

When any gauge used in this highly sensitive inspection is dropped or jarred the gauge shall be immediately checked over and re-standardized prior to further inspection of any kind.
In all thread inspections, the gauging instruments being utilized are re-standardized after the first 25 pieces have been inspected or whenever a "reject" is found.

This special attention given to the gauges utilized in thread inspection helps insure quality in the outcome of the overall inspection.

9.4 INSPECTION FLOW

Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC utilizes a specific inspection system. Listed below in order of importance and applied in this particular sequence this system assures an accurate inspection as well as back up verification:

VISUAL
[Thread Form, Black Crested Threads or Bevel and Mechanical Damage] (LC), Chamfer, Thread Length [L4, Al, NL]

PITCH DIAMETER OUT OF ROUND/OVALITY

THREAD HEIGHT

LEAD

TAPER

THREAD RUN-OUT [Buttress]

9.5 INSPECTIONS

9.5.1 Visual Inspections

Visual Thread Inspection (VTI) is a service for locating thread imperfections without the use of magnetic particles or thread gauging and inspection tools. Visually evident manufacturing defects or mechanical damage to the threads are detected by this inspection.

API STD 5B provides the parameters that are the most relevant to visual thread inspection.

To determine the LC refer to API STD 5B length of field end threads, from which these tables were made.

Note: Since the internal threads do not have an LC area, all of the threads within the interval from the counter bore to a plane located at a distance J plus one thread turn from the center of the coupling, are to be inspected to the LC area requirements.

Those imperfections located in the LC area have a different set of criteria for acceptance and rejection than those imperfections not in the LC area. Therefore, it is often necessary to measure an imperfection distance from the end of the pipe to determine if it is in the LC area or beyond.

While visually inspecting the external threads, the inspector should slowly roll individual lengths at least one full revolution checking for imperfections. Each length is rolled again while visually inspecting the internal threads.

9.5.1.1 Imperfections

Listed below are imperfections that may cause threads to be defective:

A. Broken Threads
B. Cuts
C. Grinds
D. Shoulders
E. Seams
F. Threads not fully crested (includes black-crested threads)
G. Laps
H. Pitted Threads
I. Dents
J. Tool Marks
K. Torn Threads [tears]
L. Handling Damage
M. Thick Threads
N. Narrow Threads [shaved threads]
O. Galled Threads
P. Arc Burns
Q. Cracks
R. Chattered Threads
S. Distorted or Drunken Threads
T. Threads not extending to the center of the coupling.
U. Any other imperfections that break the continuity of the thread in the LC area

9.5.1.2 Black-Crested Threads

Black-crested threads on round threads are unacceptable within the LC area.

On buttress casing two black crested threads that exceed twenty-five percent (25%) of the circumference is cause for rejection. More than two black crested threads is cause for rejection.

Note: Threads that are not full-crested have been and continue to be referred to as "black crested threads" because the original mill surface has not been removed. The term "black crested thread" is a useful descriptive term; however, it is acknowledged that there can also be non full-crested threads that may not be black.

9.5.1.3 Chamfers

Chamfers on the pipe ends have no effect on the sealing capability of the threads but should have a full 360° surface. They must not produce a razor edge at the ends, and no thread may produce a feather-edge. The starting thread must run out on the chamfer surface and not the end of the pipe.

The surfaces of the chamfers need not be perfectly smooth, but they should be free of metal burrs that may become dislodged during the make-up of threads. Burrs detected on a chamfer during inspection may be removed by filing, or grinding. Minor cuts or mashes on a chamfer, which do not affect the threads, are not rejected provided that the end of the pipe complied with other API Specifications. Occasionally, a false starting thread is observed on the chamfer of the pipe. This is a premature cut on the chamfer and is not part of the starting pipe.

9.5.1.4 Recess

The inside diameter of the recess at each end of the coupling should have a surface free of tool marks, mashes, burrs and arc burns.

9.5.2 Thread Length

A. L4 - Total thread length: From the end of pipe to point of the thread (8 round).The L4 dimension is measured parallel to the thread axis from the beginning of the thread (end of pipe) to the vanish point of the thread tool mark. The measurement is made using a metal scale with 1/32" divisions.

The total length is acceptable if L4 is within the specified tolerances + one thread turn on 8 round threads.

B. A1 is the distance from the end of the (buttress) pin to the base of the triangle stamp. A1 is measured in a manner similar to the L4 length for round thread casing. The tolerance for A1 dimension is + 1/32".
** (There is no tolerance given in STD 5B). **

C. NL-Minimum length of a coupling. NL is the coupling length and must equal or exceed the specified values provided in API 5CT. This measurement is performed by placing the steel rule longitudinally along the outside surface of the coupling.

Note: These steps of the visual inspection can be performed in conjunction with the inspection.

9.6 DIAL GAUGE INSPECTIONS

The documentation and procedure requirements to perform API thread inspections are outlined in the API Std. 5B and the API RP5B1 manuals.

9.6.1 Thread Height

Thread height (depth) is the measurement of the distance from the thread root to the thread crest normal to the thread axis.

9.6.1.1 Tolerances

A. Eight (8) Round- Eight (8) round height is .0710", and must range between .067" to .073" (+.002" /- .004") thread range height.

B. Buttress- Buttress thread height is .062", and must range between .061" to .063" in height. (+/-.001")

9.6.1.2 Gauges

A. 8-rd- There are several types of thread heights gauges which are used for inspecting round threads. External-internal gauge and internal gauge for 3" OD and smaller are used. Two types of dial Indicators are provided on the gauges:

1. Balanced dial type

2. Continuous reading type

All round thread gauges are equipped with contact points having an included angle of 50 degrees.

Both gauges should be set to zero using the U Block on a setting standard. The gauge should then be set in the V notches and used to determine wear of the contact point. Maximum wear of the contact is .0005".

B. Buttress Threads- Two styles of thread height gauges are used for buttress threads:

1. Straight anvil type external\internal height gauge (buttress pin and coupling threads 13-3/8" OD and smaller);

2. Step anvil type, external-internal height gauge; (buttress pin/coupling threads of 16", 18-5/8" and 20" diameter)

The accuracy of each type of gauge is verified by setting standards. The setting standards for the height gauge on 13-3/8" OD and smaller buttress threads are similar to the standard applications for round and line pipe threads. A step type standard is used for the height gauge associated with 16", 18-5/8" and 20" buttress casing. The steps provide correct positioning of the contact within the thread for a correct reading.

Both gauges should be set to zero using the U Block on a setting standard. The gauge should then be set in the V notches and used to determine wear of the contact point. Maximum wear of the contact is .0005".

9.6.1.3 Procedure

The proper application of the gauge to the product is performed by placing the contact point of the thread height gauge in the thread groove. The anvil must be held in firm contact with the thread crest. The gauge must be aligned with the axis of the pipe. This is properly accomplished by rocking the gauge about the longitudinal axis of the anvil. The reading obtained is correct when the dial indicator stops moving near the center of the rocking motion, the null point. This procedure is performed on the first and last full crested thread within the perfect thread length.

Note: It is most important to obtain proper thread height when trying to determine the actual pitch diameter of a connection.

9.6.2 Lead

Lead is the distance from the point on a thread turn to a corresponding point on the next thread turn, measured parallel to the thread axis. Lead measurement is taken in the perfect thread area on all API connections. (The perfect thread length is listed in API 5B.) If lead is "slow", there are too few threads per inch. If lead is "fast", there are too many threads per inch.

9.6.2.1 Lead Tolerances

There are two (2) lead tolerances to be concerned with:

A. A per inch tolerances

B. A cumulative tolerance

Eight (8) round lead is measured within the perfect thread area. The permissible limits are ± .003" per inch and ± .006" cumulative error (within L4-g).

Buttress lead (13-3/8" and smaller) is measured within L7. The permissible limits are ± .002" per inch and ± .004" cumulative error.

Buttress leads (16" and larger) is measured within L7. The permissible limits are ± .003" per inch and ± .004" cumulative error.

9.6.2.2 Lead Gauges

There are two (2) types of dial gauges available for measuring lead tolerance, each being equipped with two contact points (.072” for 8rd & .062” for Buttress) and balance dial indicator:

A. External/internal (4-1/2" OD and larger) type

B. Internal (less than 4-1/2" OD) type

The lead gauge shall register zero when applied to the setting standard. Adjustment is necessary if the gauge does not register zero. This adjustment is performed while the lead gauge is applied to the setting standard.

When gauging buttress, pressure must be applied against the gauge so the thread contact points are in contact with the load flank.

9.6.2.3 Lead Gauging Procedure

The fixed gauge point is placed on the line in the first full thread groove near the small diameter of the thread. With the movable point in the thread groove at the first interval marked, the gauge shall be pivoted in a circular arc about the fixed point on either side of the longitudinal line. The fixed point shall be against the 3° load flank. The maximum or minimum reading along the longitudinal line represents the error in lead. (Overlapping interval might be needed depending upon the length of perfect threads.)

Eight round cumulative lead is measured over the L4-g length, starting with the first full crested thread from the end of the pipe. Only perfect threads may be included in the cumulative lead measurement. Perfect threads are established same as for the thread height.

Cumulative lead is the lead measured starting with the first perfect thread over an interval (in excess of 1") which is the largest multiple of 1". The gauge is applied to the product as provided above for per inch measurement, except the cumulative lead length may include black crested threads, if the black crested threads have at least 0.031" depth. No cumulative lead measure is necessary if the black crested threads do not have a minimum of 0.035".

9.6.3 Thread Run-out (Buttress Only)

Thread run-out is the measurement of the abruptness with which the buttress thread is terminated at the triangle end of the thread. A rapid pull-out of the cutting tool results in steep slope at the end of the thread. This causes high stress at the contact point when the coupling is made up.

9.6.3.1 Gauge

The run-out gauge is a three (3) point gauge having two (2) fixed points and one (1) movable point attached to a balanced dial indicator. Accuracy of the gauge is verified by zeroing the dial indicator on a flat surface for 13 3/8" and smaller; on the perfect threads on diameters of 16" and larger.

9.6.3.2 Procedure

Two (2) possible thread run-out conditions can occur:

A. Before the base of the triangle

B. Within or beyond' the apex of the triangle

If the thread terminates before the base of the triangle, the movable pointer is placed in the last thread groove 90 degrees prior to the thread termination and the gauge rotated clockwise until the pointer exits the thread groove and rides on the pipe surface. If the thread terminates within the triangle, the movable pointer is placed in the thread groove 90 degrees prior to the thread termination or the apex of the triangle, whichever occurs first. The gauge is rotated clockwise until the point either exits the thread or passes the triangle apex.

If the thread terminates beyond the apex, the movable pointer is placed in the thread groove 90 degrees prior to the apex then the gauge is rotated clockwise until the pointer passes the triangle apex.

The run-out is satisfactory if the dial indicator does not exceed + .005" during the traverse of the thread groove. A dial indicator reading in excess of +.005" is not acceptable. All readings, including negative readings, +.005" and less are acceptable.

Contact points for the run-out gauge shall be 0.057" diameter ballpoints. For 16" and larger buttress casing the run-out gauge shall be set up and zeroed using the perfect thread roots as a setting standard. These perfect thread roots shall be checked for proper taper prior to setting up the run-out gauge.

9.6.4 Taper

Eight (8) round taper is defined as the increase in the pitch diameter of the thread, in inches per foot of the thread.

Buttress thread taper is defined as a change of external thread diameter along the pipe and along the internal thread cone. This change in the thread taper can be measured per inch and per foot.

9.6.4.1 Tolerances

A. Eight (8) round tolerance range is .060” per inch-.068” per inch within the perfect thread area.

B. Buttress taper range is .061”-.067” per inch for internal threads and .061”-.066” per inch for external on 13 3/8” and smaller within the perfect thread area. The taper range for 16” and larger is .082”-.087” for external threads and .081”-.088” for the internal threads.
(Within the imperfect thread tolerances area are +.054"/ft. -.018"/ft.)The taper and taper tolerance(s) are listed in Std. 5B in feet: however, the Inspector must work in inches; therefore, to convert these specifications one must divide by 12 to get the per foot tolerance(s).

9.6.4.2 Taper Gauges

Three (3) different gauges are available for inspection of thread taper:

A. External - Thread taper caliper

B. Internal - Thread taper gauge for threads on 4-1/2" OD and larger

C. Internal - Thread taper gauge for threads on pipe less than 4-1/2" O.D.

These particular gauges are provided with a continuous dial type indicator. The gauge contact points must comply with the type of thread being inspected.

A. Eight (8) round contact points: .072"

B. Buttress contact points: .090" in diameter.

Taper gauges are adjusted on the pipe to be inspected. The threads must be provided with a longitudinal line divided into 1" (1/2") intervals. The caliper is adjusted (zeroed) by placing the fixed contact point on the longitudinal line in the groove past the first full crested thread. The movable contact point shall be placed in the same groove diametrically opposite the fixed contact point. The fixed point shall be held firmly within the thread groove while the movable point is oscillated through an arc within the groove. The dial pointer shall indicate zero at the maximum reading. The dial indicator should be adjusted if the reading is not zero.

9.6.4.3 Eight (8) Round Taper Procedure

External-The external taper gauge is applied in the same fashion as during adjustment. The gauge is applied at 1" intervals from the small toward the large diameter of the thread.

Eight (8) round external taper is measured over the L4-g length (i.e. - perfect thread length). When the last interval of measurement is less than 1", the gauge is placed in the last full thread groove.

Internal-When determining eight (8) round internal taper, the gauge is adjusted on the coupling. The coupling threads must be provided with a longitudinal line divided into 1" intervals. For inspection purposes, the coupling full crested thread length extends from the first perfect thread (third thread root from end of recess) to the J + 1 thread length (fifth thread and sixth thread from coupling center for 8 round and 10 round).

The internal taper gauge shall be inserted into the coupling so the movable contact point is at the top of the coupling and the fixed contact point is at the bottom of the coupling. The gauge is adjusted by placing the fixed contact point on the longitudinal line in a thread groove five (5) threads from the center of the coupling for 8 round. The movable point is placed in the same groove 180 degrees opposite from the fixed point. The dial indicator shall be at zero at the null point as the movable point is moved through a small transverse arch.

The taper is measured by taking successive readings at 1" intervals moving toward the near opening of the coupling.

Note: Based on the LC length, in some cases the connection shall require for the taper reading to be read at ½" intervals. In the instance that ½" intervals are required the reading shall be multiplied by 2 to obtain the actual taper reading.

9.6.4.4 Buttress Taper Procedure

The procedure discussed in the "Round Thread" section should be followed. Taper is inspected over the thread length as discussed in the "Buttress Thread Cumulative Lead" section.

External-Unlike other threads, two areas of the buttress threads must be inspected; the perfect threads and the imperfect threads. The taper of perfect threads (no black crested threads) is inspected at 1" intervals, overlapping as necessary to inspect the entire length. A similar procedure is applied to the imperfect threads.

Tapers and corresponding tolerances are different for the perfect and imperfect threads and for 13-3/8" OD and smaller pipe and 16" OD and larger pipe.

Internal-The gauge is adjusted on the coupling. The procedure discussed in the "Round Thread" section shall be applied. The length L4 + .5" thread pitch from the face of the coupling shall be inspected at 1" intervals.

The taper gauge is applied to the product in the same fashion as gauge adjustment. The round thread inspection procedure is followed. The internal thread inspection starts at the first perfect thread (first root from the open end of couplings having full crested threads on both sides) and proceeds to the L4 + 1 thread pitch.

The buttress thread coupling shall contain only perfect threads in the interval L4 + 1 pitch to the coupling end. Accordingly, only perfect thread taper and tolerance is determined. However, different taper tolerances apply to 13-3/8" OD and smaller couplings than apply to 16" OD and larger couplings.

9.6.5 Pitch Diameter & Out of Round/Ovality

Stand-off- The distance measured axially from end of pipe or coupling to a reference point on the ring or plug.

Pitch diameter- The diameter of the pitch on the size of an API connection at E1 or E 7 as specified in API Std. 5B.

9.6.5.1 Relating Pitch Diameter to Stand-off

The measurement of "stand-off" on threaded connections is a method indicating pitch diameter. This method does not allow for ovality of the connection which can yield an incorrect reading of "stand-off". All elliptical connection can check o.k. on tolerance and yet the oval condition has pitch diameter below acceptable specifications.

By taking readings about several axes, the ovality can be averaged out to "effective" pitch diameter.

9.6.5.2 Pitch Diameter Gauge

Pitch diameter and ovality is determined by the use of an MRP gauge.

All setting standards are manufactured traceable to the National Institute of Science and Technology. The setting standards are calculated and manufactured strictly to adhere to the data provided in API standard 5B. This data provides the required pitch diameter at the "plane of hand-tight engagement" for all API connections.

The first pipe is used to set the pitch diameter gauges to the proper length from the end of the pipe to the plane of pitch diameter and to the proper pitch diameter. (Axial setting standards and pitch diameter setting standards are applied for gauge calibration.)

The gauge is positioned over the end of the threaded product with bearing pads positioned against the end of the pipe. Using the lower contact shoe as a pivot point, the gauge is pivoted across the thread crest until the indicator changes direction.

The highest and lowest indicator readings are determined for averaging pitch diameter as well as documentation purposes. Ovality is measured at the same time. Lg Diameter + Sm Diameter/ 2 = Diameter

Ovality and/or out of round can be determined by rotating the MRP gauge about the axis of the pipe and positioning shoes at various points about the circumference.

Lg. readings – Sm reading= Ovality

9.6.5.3 Tolerances

The tolerances listed below are used for inspection purposes: *(unless otherwise specified by the customer)*

8 Round 3/4 TPF

Pin Pitch Diameter +/- .008

Box Pitch Diameter +/- .008

Buttress 3/4 TPF

Pin Pitch Diameter - 0 / + .004

Box Pitch Diameter - .004/+ 0

Buttress 1" TPF

Pin Pitch Diameter - 0 / + .004

Box Pitch Diameter - .004/+ 0

Maximum Ovality Tolerances are calculated by the diameter of the pipe multiplied by .003
Example:
8 5/8 casing is the diameter of the pipe that is being threaded
8.625 x .003 = .0025

9.6.6 Thread Profile Gauge

The Thread Profile Template is a precision-hardened and ground thread tooth form used to check the product thread groove.

Place the thread profile gauge in the perfect thread area. The gauge teeth should fit in the pin or box threads without lateral movement or interference (ride up on flank threads). Such indications of imperfect fit may indicate a problem in the thread form. Rejection of the thread should not be made until the thread pitch, taper, thread height, flank angle, and/or thread profile as measured with a thread comparator or other thread form measurement device has verified the condition.

9.6.7 Ring Gauge

ETMT utilizes 3 types of gauges that are addressed in this bulletin. A Flush type gauge where basic is the face; a Basic (gauge face) and minimum step type gauge; and a basic, minimum and maximum external mounted on gauge face type gauge.

The connections to be gauged must be free of all tears, burrs or debris for the correct application of the ring gauge.
The gauge should be wiped clean with non-detergent type oil and a lent free cloth. All excess oil should be wiped from the surface.
The ring gauge is used by screwing the gauge onto the pin to be inspected to the hand tight plane and observing the number of threads between the end of the pin and the reference point of the gauge.
The tolerance on 8rd threads is ±1 P and buttress threads being + ½ P,-0P. These are listed in 5B Para. 6.1.4 and are the tolerances on the P1 value of the ring gauge. P is a thread turn.
The P1 value is the standoff value of the working ring gauge to the master plug gauge and is calculated values from master ring and plug gauges. This value is listed on the calibration paperwork for that serial numbered gauge. Each fixed gauge will have a different P1 value. Tolerance values will need to be adjusted with each gauge.
The P1 value is not included in the thread manufactured form. This value has to be included in the measurement for acceptance.

Example: a P1 value of +.0048" has to be included in a base dimension prior to tolerance inclusion. The new basic dimension is now at +.0048" with a tolerance of ± 1Thread turn on an 8rd connection. With the thread turn value in this case being .125", the measured distance from the basic dimension of the ring gauge is + .1298", - .1202". If the measured reading falls within this distance it is acceptable.

Upon completion of using the ring gauge it should be cleaned with a non abrasive and non corrosive cleaner. The gauge will receive a light oil application over all machined surfaces prior to storage.

9.6.8 Power-Tight Make-up

Although the tolerance for 8 round is not API specified, it is provided as a guideline for determining power-tight make-up. (Provided in API 5B1).

Determine the coupling length (NL); divide by 2, and J area (NL/2+J). This is the nominal position of the end of pin in coupling. Measure the distance from the face of the coupling to the end of pin inside the coupling. When using a metal scale, the inspector marks his nominal make-up position and the stand-off/stand-in positions. If the measured distance is different from the nominal distance by more than two (2) thread turns the condition is reported to the QC for classification.

The same procedure utilized for 8 round applies to buttress for determining nominal make-up (N/2 + J). For back up verification the inspector can reference the end of the couplings to the triangle stamp. The face of the coupling should be located within one (1) thread turn from the base of the triangle and no further than the apex of the triangle. If the coupling is not made-up to the proper position on the triangle stamp, it is reported to the customer.

9.7 POST INSPECTION

9.7.1 Acceptance and Reject Markings

Listed below are marking(s) which inspected material and Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC reporting provides identification of:

A. Acceptable material is stenciled in white and the following information is indicated:

1. Manufactures Name
2. API Number
3. Customer Name
4. Customer Purchase Order or Job number
5. Work Order Number
6. Date
7. Size
8. Weight
9. Grade
10. Type of connection
11. Manufacturer
12. Date

Note: See Procedure 7.5.3AA for detail of stenciling.

B. Rejected material is identified by red paint bands around the OD of a bad coupling, or around the pipe OD beyond the last pin thread of a rejected pin connection.

C. When measurement rejects a coupling, the type, value and location of the measurement is noted on the OD of the coupling with a metal marker.

D. When a measurement of elements of a pin or box end are not in tolerance the connection will be marked and identified as reject.

E. When a reject has been identified, communication with the CNC Operator and/or the production supervisor is priority to prevent excessive rejects and loss of material

F. The identification requirements of (C) and (D) are noted on a Reject Sheet report form that is provided to the customer by Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC

9.7.2 Reporting

All thread dimensions as required will be reported on the inspection data sheet. QA upon review of all data will authorize a COC be issued validating the manufacture of thread forms by ETMT.

SECTION 10 - RECEIVING, STORAGE, SHIPMENT OF OCTG

10.1 Scope

The RECEIVING, STORAGE, SHIPMENT OF OCTG will be processed by Technical Industries, Inc. and overseen by Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC Energy & Technology, Corp / Energy Technology Manufacturing & Threading, LLC will assure and verify that the following process and instructions are followed.

This Work Instruction covers the handling of OCTG products into Technical Industries, Inc. facility and their material control inventory system. The application of this work instruction will enhance the identification and traceability of the material in the system while physically handling the material without detriment to the material.

Once a work order has been received and a process router has been distributed the material is ready to be processed to Energy & Technology Corp / Energy Technology Manufacturing & Threading, LLC. form F-7.5.3-3 shall be signed off on prior to transferring materials to the threading facility.

Any pipe condition observed during transfer shall be noted on the transfer form F.7.5.3-3.

Once the material has been received and the work order processes have been completed, form F-7.5.3-3 shall be signed off on and the materials shall be processed back in to T.I. inventory. A detail of all all process result shall be completed and distributed as part of F-7.5.3-3.

10.2 Referenced Documents

API RP 5A5 *Field Inspection of New Casing, Tubing and Plan End Drill Pipe*

API RP 5C1 *Recommend Practice for Care and Use of Casing and Tubing*

Technical Industries, Inc. Material Control and Inventory System

10.3 Personnel Qualification

All personnel using OCTG handling equipment shall be qualified to operate the forklift they are assigned. All lift operators shall be tested on safety and operating knowledge on a regular interval. All lift operator new hire's shall be given a safety and operating knowledge test within the first 30 days of hire.

Technical Industries, Inc. uses an outside safety consultant to qualify the forklift operators.

The Technical Industries, Inc. inventory system should only have data input by a thoroughly trained input operator. Abilities shall be judged by the S&R Supervisor and the Software Engineer.

10.4 Equipment

All equipment assigned to the department will be kept in a well maintained status. Maintenance will be performed at the prescribed intervals required by the maintenance program.

No load bearing system of the lifts shall exhibit any fluid leaks or fatigue cracking, when being used to handle weighted material that might jeopardize the operator or the condition of the material being moved.

Equipment shall never be operated with a lifted weight that exceeds the recommended operating capacity of the lift.

10.5 Receiving Material

10.5.1 All inbound material shall be assigned a Work Order Number prior to the unloading of any vehicle. An authorization to accept the material into the yard from the assigned customer on the Work Order shall have been documented. The authorization should list the material description and quantity to be received as a minimum. The Work Order number assigned is a specific identification of the Technical Industries, Inc. inventory system that allows a history of activity to be generated while the material is in the possession of Technical Industries, Inc.

10.5.2 During offload of the material it shall be verified to be of the same description as listed on the Work Order and shall have the same number of pieces on the carrier as listed on the Bill of Lading.

10.5.3 All joints shall be identified by metal marker or stencil by the assigned Work Order number. In case of bundles, as many joints as possible shall be identified and marked. If material is in a crate the description of contents shall be verified but the crates shall not be opened prior to service for verification unless by customer request.

10.5.2 All material requiring special handling shall be identified prior to offload and the forklift shall be set up to facilitate the off-load. All CRA material shall be considered special handling. Padding of forks to prevent any metal to metal contact will be the standard for special handling. TI shall maintain a set of equipment that can be utilized to handle these special needs. All material will receive careful handling whether new, used or reconditioned.

10.5.3 When material is being accepted into the facility and into the inventory system the following shall be verified and made note of:

- Joint count

- Pipe Description
- Condition of thread protectors when applicable and number missing.
- General overall material condition.
- Any previous service stenciling.

Tallying of inbound material is not provided unless by customer request. At Technical Industries tallies are provided at point of service. If tally is requested T.I. QMS form F-7.5.3-1 Material Tally Sheet shall be used.

10.5.4 Upon verification of material with joint count by the yard crew the material quantities and any observed discrepancies shall be noted under the work order number assigned in the material control system. Input shall include date received, carrier information, total quantity and services to be performed or noted for storage only. A hard copy of the Work Order shall be issued on QMS form F-7.5.1-1.

10.5.5 Threaded material shall never be moved without appropriate thread protectors installed.

10.5.6 Upon completion of inventory input into the TI control program the Work Order will be either issued for services ordered or listed as Customer Storage. All hard copies of inbound paperwork will be placed in a Work Order specific file for records. All electronic activities generated by the services provided will be assigned to this specific work order e-file. Hard copies of the Work Order (F-7.5.1-1) will be generated as needed and placed in the assigned hard copy work order file.

10.5.7 Any additional charges that occur during offload, i.e. Overtime, shall be documented on the e-file Work Order and the hard copy. The additional charges shall be stipulated on T.I. QMS form F-7.2-2 and approved. This form shall become part of the e-file and the hard copy file.

10.6 Storage

10.6.1 Material received for storage or is in process for services will be stored on racks that are stable for the weight load. Pipe will not be placed directly on ground, rails, steel or concrete floors.

10.6.2 First tier of pipe will be no less than 18” from the ground to keep moisture and dirt away from pipe.

10.6.3 Pipe should rest on supports properly spaced to prevent bending of the pipe or damage to the threads. The stringers should lie in the same plane and be reasonably level and be supported by piers adequate to carry the full stack load without settling.

10.6.4 Wood strips shall be placed as separators between successive layers so that no weight rests on the couplings or end connections.

10.6.5 Spacing strips shall be placed at right angles to pipe and directly above the lower strips and supports to prevent bending of pipe. It is recommended to use at least 3 spacing strips per layer.

10.6.6 Each layer of pipe shall have the WO number identification written on it with the number of joints specific to that row of pipe also written on the first visible joint of that layer.

10.6.7 Any rack that contains more than one Work Order number shall have a clear designation of where one work order ends and another commences.

10.6.8 At no time will material of different work orders be randomly mixed on a rack.

10.6.9 Each layer of material on a rack shall be blocked on the pier and spacing strips by either 1x2 or 2x2 blocks to prevent pipe movement. The blocks should be held firmly in place by nails, but care should be taken that the nails are not driven so as to make contact with the blocked material.

10.6.10 Pipe shall be racked so that all mill ends are in one direction and all field ends are in the opposite. Mixing of alignment is not permitted unless by customer request and the request must be documented.

10.6.11 All prime material should be racked separate from non-accepted material. The appropriate banding from the services rendered should note what is accepted and what is not. This report should become part of the electronic and hard copy file.

10.6.12 Pipe in storage should be inspected periodically and protective coatings applied when necessary to arrest corrosion. This should include all threads and exposed surface areas.

10.6.13 All material receiving service shall be noted on the material control inventory system. All classifications producing banding and joint quantities shall be recorded in the inventory program. All banding and joint counts shall be verified by a specified yard person.

10.6.14 All quantities receiving service and quantities not receiving service with the adjustment to original received quantities shall be reconciled and be equal prior to any shipments.

10.6.15 All pipe movements should be recorded for checks and balances as they are moved. This will ease the reconciliation of all total movements for service or shipment.

10.6.16 Quantity and description of the inventory being held is an ongoing verification. A complete physical inventory will be done on an annual basis.

10.6.17 Material in storage for a customer may be sold off or transferred to another customer. Such transactions must be recorded and approved. Transfer authorization shall occur, using T.I. QMS form 7.5.3-3 and shall become a part of the e-file and the hard copy file for both customers.

10.7 Shipment of Material

10.7.1 Prior to shipment of any material the physical inventory of that work order and the electronic quantities of that work order must match.

10.7.2 Before any material can be loaded onto a carrier a material release must be on file with the S&R office. It is preferred that a written release either by fax or email be on record but if the material is to be released by verbal communication than a note must be made of person talked to, time and date of conversation. No third party notification will be accepted unless it is an authorized representative of the customer.

10.7.3 A 24 hour notice of shipment should be requested from all customers in order to efficiently take care of their request.

10.7.4 All material during the load out operation will receive careful handling but if noted for special handling associated equipment will be used to facilitate the load out.

10.7.5 No threaded material will be moved without thread protectors in place.

10.7.6 Lift operators shall not jeopardize the material by attempting to load too many joints onto one lift load. Pipe during loading should be handled as a single layer on fork lift tines.

10.7.7 Pipe shall be loaded onto the carrier so as to distribute the weight equally on the axles of the carrier.

10.7.8 Load pipe with all mill ends in the same direction and all field ends in the same direction.

10.7.9 Pipe descriptions and quantities being loaded onto each carrier shall be verified against the release and submitted to the S&R office prior to release of the truck. The activities shall be assigned to a responsible person for physical attention.

10.7.10 Care should be taken that couplings or tool joints are not rubbed against each other during loading or final disposition on the truck.

10.7.11 Although not the responsibility of Technical Industries, any inadequate tie- down system on the carrier should be brought to the drivers' attention for correction.

10.7.12 The truck shall not be overloaded.

10.7.13 The truck with its load shall have the quantity and description verified prior to release from the yard. This information shall be listed on an S&R created Bill of Lading, T.I. QMS form F-7.2.2-5 located in Technical Industries QMS.

10.7.14 Pipe will receive an out bound tally recorded on QMS form F-7.5.3-1 located in Technical Industries QMS, to verify amount of footage being shipped and the piece count.

10.7.15 The inventory system shall be adjusted by each truck load of material that leaves the yard. This adjustment is for repair, or final shipment.

10.7.16 All customer generated requests shall be documented and become a part of the permanent file.

10.7.17 Any additional charges occurring during load out, i.e. Overtime, shall be documented on the e-file and hard copy file. T.I. QMS form 7.2.2-3 located in Technical Industries QMS ,shall be completed for the approval of these charges. The form shall become a part of the e-file and the hard copy file.

10.7.18 Upon final activity in the Work Order and verification of all activities recorded in the e-file and the hard copy, the order shall be archived and kept for any future questions. The minimum time for storage should be 5 years.