DOCUMENT RESUME

ED 261 239 CE 042 466

TITLE Apprentice Outline. Piping Trades PH1. Pipehanger Theory I (Marine).
INSTITUTION Connecticut State Dept. of Education, Hartford. Div. of Vocational-Technical Schools.
PUB DATE 84
NOTE 82p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Apprenticeships; Behavioral Objectives; Building Trades; Classroom Techniques; Equipment Evaluation; *Equipment Utilization; Guidelines; *Inspection; Learning Activities; Measurement Equipment; Measurement Techniques; *Plumbing; Postsecondary Education; State Curriculum Guides; Teaching Methods; *Trade and Industrial Education; *Welding
IDENTIFIERS *Submarines

ABSTRACT

This course outline is designed for use in teaching apprentice pipehangers how to use various installation procedures needed to install hangers aboard submarines. Addressed in the individual units of the course are the following topics: job preparation, job verification, material verification, weld preparation, fit-up, inspection of completed assemblies by a tradesperson, and presentation of completed assemblies to inspection. Each unit consists of a series of master lesson plans, each of which contains some or all of the following: lesson objectives, presentation guidelines, tests, student handouts and learning activities, and suggested references. (MN)

APPRENTICE OUTLINE
PIPING TRADES PH1
PIPEHANGER THEORY I
(Marine)

DIVISION OF VOCATIONAL-TECHNICAL SCHOOLS

CONNECTICUT DEPARTMENT OF EDUCATION

1983-1984

PH1 - PIPEHANGER THEORY I (Marine)

Class

OBJECTIVES:

This course is designed to make the apprentice aware of the various pipehanger installation procedures needed to install hangers aboard submarines according to all design specifications

I. JOB PREPARATION

A. Tools and Safety Equipment
B. TRIDENT or 688 Class CCDI's
C. Applicable Piping Blueprints and Hanger Details
D. Applicable EN's and CM's

II. JOB VERIFICATION

A. Find and Verify Location of Pipe
B. Hanger Installation Tolerances
C. Piping Temporarily Supported

III. MATERIAL VERIFICATION

A. SWSS System
B. Verify Proper Hanger Assembly
   1. Types of materials required
   2. Structural materials and thicknesses
      (Note: This to be done using hgr. detail dwg. and applicable standard dwgs.)
   3. Fasteners
   4. Cure dates of rubber items
   5. Paint schedule
   6. Hanger configuration according to detail drawing

IV. WELD PREPARATION

A. Weld Symbols
B. Attachment Point Surface Preparation
C. Color Code System

PH1 - PIPEHANGER THEORY (Marine) I (continued)

V. FIT-UP

A. Check for Final Location and Orientation
B. Check to Insure Hanger is Within Design Tolerances
C. Insure all Fasteners are Properly Secured
D. Maintain Required Clearances
E. Weld Supervisior must "Buy" Fit-Up prior to Welding or Tacking

VI. INSPECTION OF COMPLETED ASSEMBLY BY TRADESPERSON

A. Location By Plan
   1. Hanger Installed To Plan Tolerances
   2. Use Of Tolerance EN (If required)
B. Material Verification
   1. Proper Materials and Thicknesses
   2. Proper Rubber and/or Resilient Elements within Cure Dates

VII. PRESENTATION OF COMPLETED ASSEMBLY TO INSPECTION

A. SWSS System
   1. Properly Filled-In SWSS Card
   2. All Applicable Plans, Standard Drawings and EN's or CM's as Required

MASTER LESSON PLAN

I. COURSE TITLE - PH - 1 LESSON NUMBER 1

Name Of Instructor _____ Day/Period Taught _____

II. OBJECTIVES OF LESSON :

This course is designed to make the apprentice aware of the chronolocical order of PIPEHANGER INSTALLATION PROCEDURES for both resilient and non-resilient pipe-hanger assemblies.

III. PRESENTATION

A. Handout a sheet describing the course outline and student requirements.

B. Go over student requirements.

C. Introduce and discuss at length the course outline, highlighting problem areas.

IV. TESTS

None

V. MATERIALS

Copies of course outline

VI. REFERENCES

None

MASTER LESSON PLAN

I. COURSE TITLE - PH-1 LESSON NUMBER 2

Name of Instructor_____ Day/Period Taught_____

II. OBJECTIVES OF LESSON:

This lesson will make the apprentice knowledgeable in the various types and uses of tools, gauges and safety equipment to be used performing his/her required tasks.

III. PRESENTATION

A. Discuss the use of Bar Code badges, where used and when used. Emphasize importance of returning tools by end of shift,ie: not enough tools for all personnel on all shifts if tools are not returned.

B. Discuss departmental loan orders, how and why used.

C. Discussion of basic hand tools used by Pipehanger trade.

D. Micrometers and the Vernier Caliper

1. Micrometers (mikes)

a. Micrometers measure distances to the nearest thousandth of an inch.

b. Outside mikes, inside mikes, intrimikes, and depth mikes are used most frequently.

aa. The outside mike is used to measure outer dimensions, such as outside diameters and widths of stock.

ab. The inside mike and intrimik:are used to measure inner dimensions, such as the inside diameter of a tube or hole. The inside mike is also used to measure between surfaces.

1b.(cont.)

ac. The depth mike is used to measure the depth of holes or recesses and the distances between shoulders and flanges.

C. Micrometer size varies from 1 inch up and indicates the largest size of stock the micrometer can measure.

D. Most outside mikes have a range of 1 inch: 1-inch mikes measure from 0 to 1 inch; 2-inch mikes, from 1 to 2 inches; 3-inch mikes from 2 to 3 inches and so forth.

E. Since each micrometer's range is limited, first find the approximate measurement with a rule, then make a refined measurement with the appropriately sized mike.

a. Example - If a piece of stock is approximately 3-1/2 inches wide, select a 4-inch outside mike to establish the exact measurement.

b. For inside and depth micrometers, fit rods of suitable lengths into the micrometer to get the approximate measurement within an inch, then adjust the micrometer for an exact reading.

F. Point out the various parts of the outside micrometer as illustrated in the transparency.

a. Frame
b. Anvil
c. Spindle
d. Sleeve
e. Thimble
f. Ratchet Stop

G. Turn the thimble to move the spindle toward and away from the anvil.

H. The spindle has 40 threads per inch; every time the thimble completes a revolution, the spindle advances or recedes 1/40th-inch (0.25-inch)

I. The sleeve is divided into 40 equal parts per inch.
   a. Every fourth division is numbered 1, 2, 3, 4, etc., representing tenths; i.e. 0.100-, 0.200-, 0.300-, 0.400-inch, etc.
   aa. The three smaller lines drawn between each tenth represent 0.025-, 0.050-, 0.075-inch.

J. The thimble scale is divided into 25 equal parts, each part representing 1/25 of 0.025-inch or 0.001.
   a. Every fifth line on the thimble scale is marked 5, 10, 15, etc.,representing 0.005-, 0.010-, 0.015-inch, etc.

K. To read a micrometer, use the following procedure.
   a. Adjust micrometer for stock size by turning the thimble.
   aa. Read the measurement on the sleeve where the edge of the thimble has stopped.
   ab. First read the number labeled on the sleeve closest to the thimble edge. This number indicates tenths.
   ac. Next see which one of the lines past the tenths marking is closest to the thimble edge. This indicates either 0.025-, 0.050-, or 0.075-inch.
   ad. Add these two numbers for the sleeve reading.

L. Add the thimble reading to the sleeve reading as thousandths.
   a. Read the thimble scale where the horizontal sleeve line coincides with the vertical thimble scale.

M. Review the sample illustrated on the transparency.
   a. Remind students that the example illustrates a 1-inch outside micrometer; therefore, the final reading is a decimal fraction.

N. When using an inside mike, insert a rod of the appropriate length.
   a. To read an inside diameter, insert tool into the tube or hole along the diameter.
   aa. Rotate thimble until the mike fits snugly.
   ab. Read this mike in the same manner used for the outside mike.

2. Vernier Caliper

   a. The vernier caliper provides accurate measurements over a large range for both internal and external dimensions.

   b. Point out parts of the vernier caliper as illustrated in transparency.
      aa. Fixed Jaw
      bb. Sliding Jaw
      cc. Main Scale
      dd. Vernier Scale

   c. Inches and tenths of an inch are labled on the main scale.
      aa. Divisions between tenths represent 0.025-. 0.050. and 0.075-inch.

   d. The reading on the vernier scale represents thousandths of an inch.

e. Follow this procedure when reading a vernier caliper:

aa. Find the zero on the vernier scale where it meets the main scale.

bb. Read the number of whole inches indicated on the main scale.

cc. Add to that the number of tenths and either 0.025, 0.050, and 0.075 as indicated on the main scale.

dd. If the zero on the vernier scale does not line up precisely with a line on the main scale, find the line on the vernier scale which coincides with a line on the main scale. Add this number to your previous sum as thousandths.

ee. When measuring an inside diameter, add 0.004-inch to the caliper reading to account for jaw thicknesses.

f. Explain example illustrated on tranparency.

TOOL CARE

aa. Clean, lightly oil, and properly store these precision tools.

bb. Do not tighten the spindle on the outside mike precision tools.

cc. Do not drop these tools or slide work over their surfaces.

F. Discuss hand tool and shipyard safety.

IV. TESTS

Reading Micrometers
Reading Vernier Calipers

V. MATERIALS

Handout: Reading Micrometers and the Vernier Calipers

VI. REFERENCES

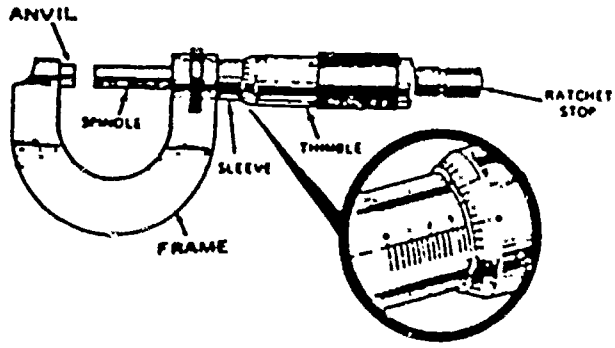
Browne & Sharpe: The Young Machinist's Handbook

I. MICROMETERS (Mikes)

A. Micrometers measure to the nearest thousandth of an inch.

B. Become thoroughly familiar with micrometer nomenclature. The outside mike has the following parts.

1. Frame
2. Anvil
3. Spindle
4. Sleeve
5. Thimble
6. Ratchet stop



C. Follow this procedure when reading a micrometer.

1. Adjust mike for stock size by turning the thimble.

2. Read the measurement on sleeve where the edge of the thimble has stopped.

a. First read the number labeled on the sleeve which is closest to the thimble edge. This number indicates tenths of an inch.

b. Next see which one of lines past the tenths marking is closest the thimble edge. This indicates either 0.025-, 0.050-, or 0.075-inch.

c. Add these two numbers for the sleeve reading.

3. Add the thimble reading to the sleeve reading as thousandths of an inch.

a. Read thimble scale where horizontal line on sleeve meets thimble scale.

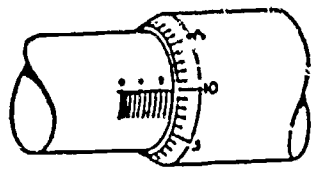
4. See the example below.

a. The "2" on the sleeve is the number which is closest to the thimble edge. This "2" represents 2 tenths or 0.200.

b. The second line past the "2" is the line closest to the thimble's edge. This line represents 0.050.

c. The "10" on the thimble scale coincides with the horizontal line of the sleeve scale. This reading represents 10 thousandths or 0.010.

d. Add these three numbers.



0.200
0.050
.010
0.260

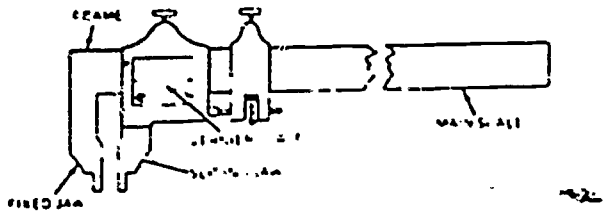
e. The final measurement is 0.260-inch.

II. VERNIER CALIPER

A. The vernier caliper provides accurate measurements over a large range for both internal and external dimensions.

B. The vernier caliper has the following parts.

1. Fixed jaw
2. Sliding jaw
3. Main scale
4. Vernier scale



C. Inches and tenths of inches are labeled on main scale.

1. Divisions between tenths represent 0.025-, 0.050-, and 0.075-inch.

D. The vernier scale indicates thousandths of an inch.

E. Follow this procedure when reading a vernier caliper.

1. Find where the zero on the vernier scale meets the main scale.
2. Read the number of inches indicated on the main scale.
3. Add to that the number of tenths and either 0.025, 0.050, or 0.075 as indicated on the main scale.
4. If the zero on the vernier scale does not line up precisely with a line on the main scale, find the line on the vernier scale which coincides with a line on the main scale. Add this number as thousandths to your previous sum.

5. When measuring an inside diameter, add 0.400-inch to the caliper reading to account for jaw thicknesses.

6. See the example below.

   a. The zero on the vernier scale meets the main scale after the 1-inch mark and one line past the 4-tenths mark.

   b. Add 0.400 and 0.025 to the 1 inch.

      1.000
      0.400
      0.025
      1.425

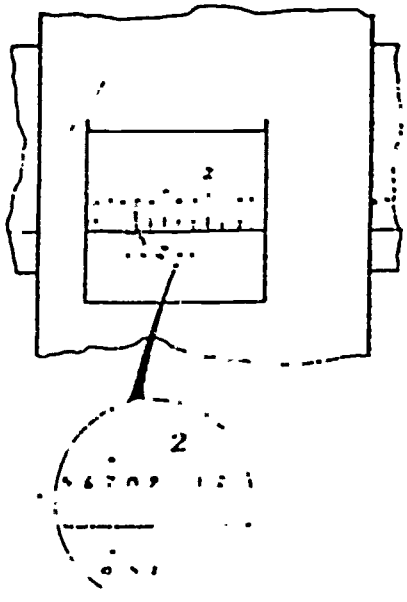
   c. Since the zero does not line up exactly with the 1.425 line, find the line on the vernier that coincides with a line on the main scale.

      1) "11" lines up with a line on the main scale and represents .11 thousandths.

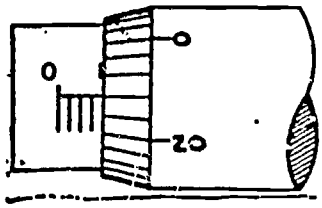
      2) Add 0.011 to your previous sum.

         1.425
         0.011
         1.436

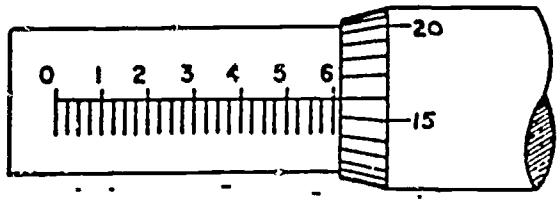
   d. The caliper reading is 1.436-inch.



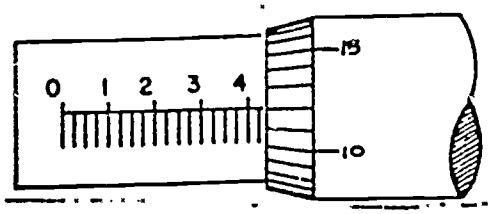
Directions: List measurements shown on micrometer to nearest 1/10

1. 

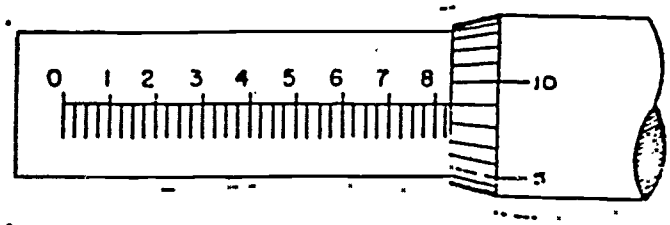
ans._____

2. 

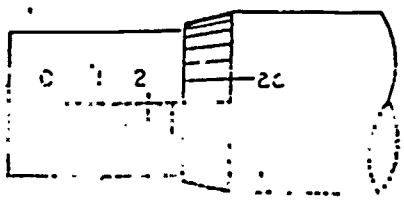
ans._____

3. 

ans._____

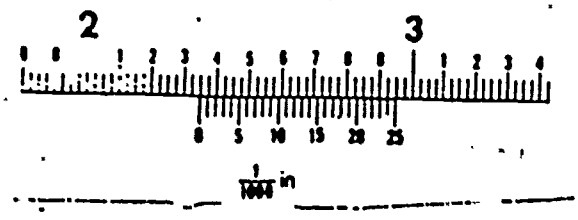
4. 

ans._____

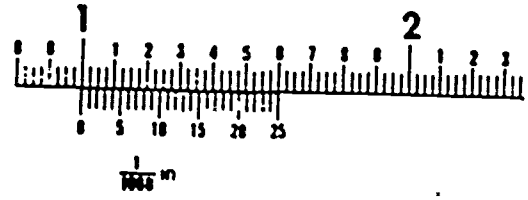
5. 

ans._____

Directions: List the following vernier caliper measurements.

6. 

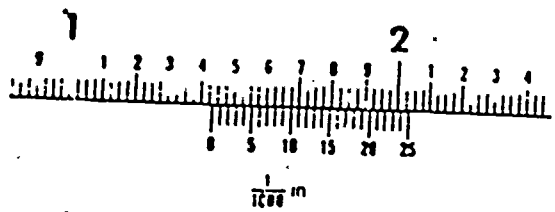
ans._____

7. 

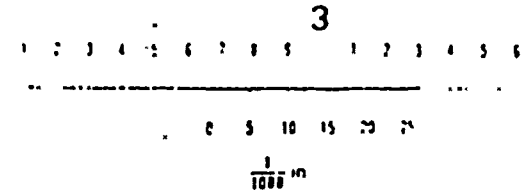
ans._____

8. 

ans._____

9. 

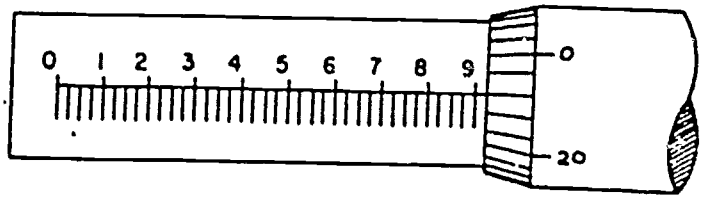
ans._____

10. 

ans._____

NAME _____
BADGE _____ DEPT ____
DATE _____

List the following micrometer measurements.

1. 

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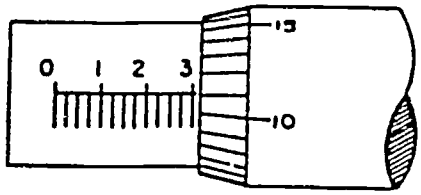
2. 

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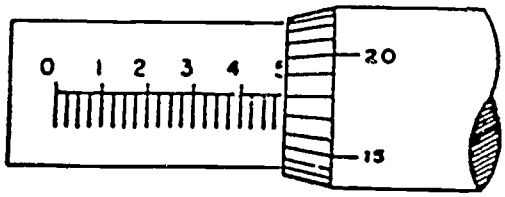
3. 

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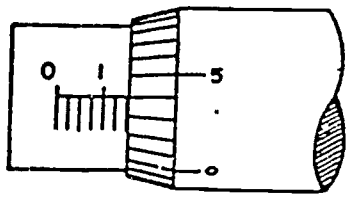
4. 

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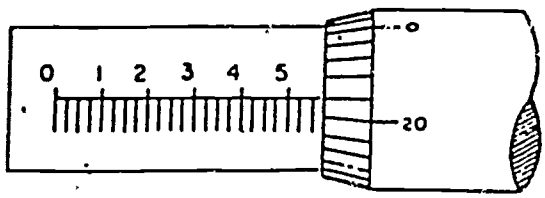
5. 

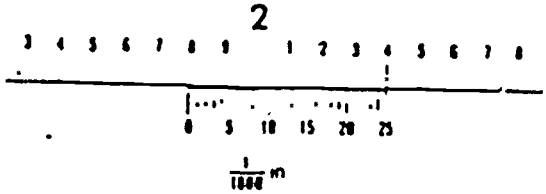
_____

List the following vernier caliper measurements.

6.

7.

8.



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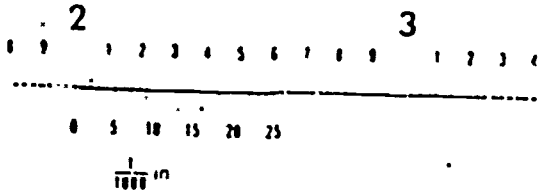
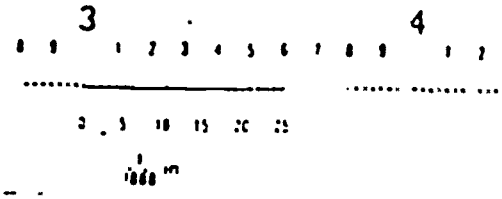


10.



MASTER LESSON PLAN

I. COURSE TITLE - PH - 1 LESSON NUMBER - _____

Name Of Instructor _____ Day/Period Taught _____

II. OBJECTIVES OF LESSON :

Upon successful completion of this lesson the apprentice will have the knowledge to obtain all applicable piping blueprints and hanger details to perform his/her assigned tasks.

III. PRESENTATION

A. Handout blank drawing withdrawal/retrieval requests and discuss procedure for procuring drawings.

B. Issue plan #87765-2301 along with handout on blueprint format.

IV. TESTS

Blueprint Format Quiz

V. MATERIALS

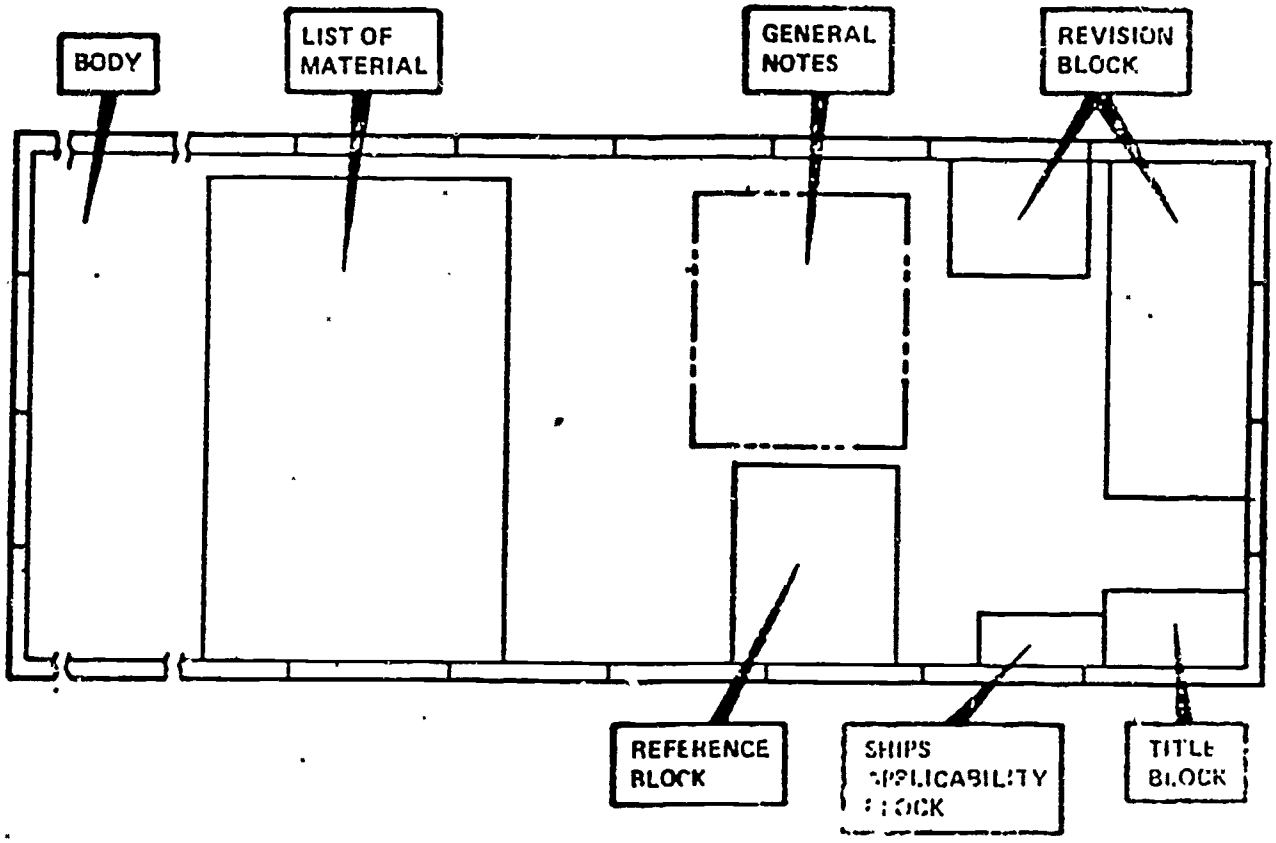
A. Drawing Withdrawal/Retrieval Requests (Blanks)
B. HANDOUT Blueprint Format
C. E.B. Plan #87765-2301
D. QUIZ Blueprint Format

VI. REFERENCES

None

Drawings are the means by which engineers and designers communicate with tradesmen. The more standard the format, the easier the drawing is to read. A standard format means that the same kind of information is always found in the same place.

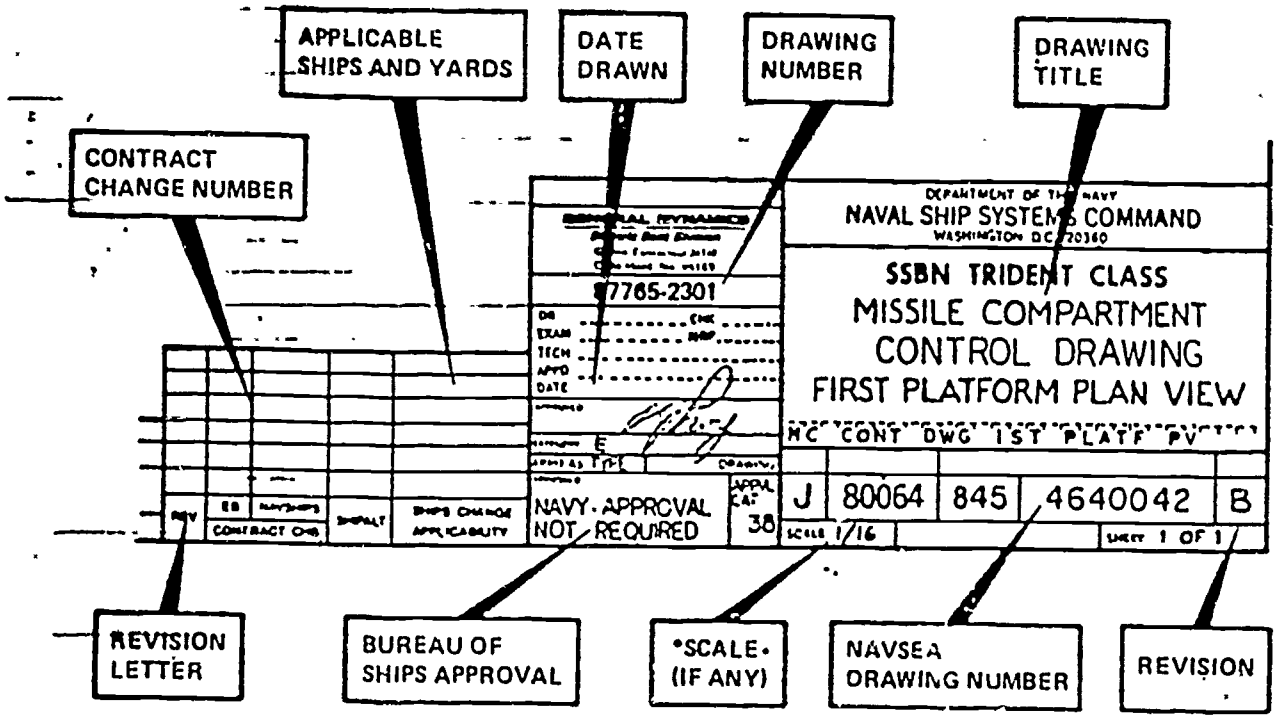
A typical example is an SSBN TRIDENT Class piping drawing, 87765-2301, whose standard format makes needed information much easier to find. The figure below shows the most usual arrangement of this information on a drawing.



STANDARD FORMAT

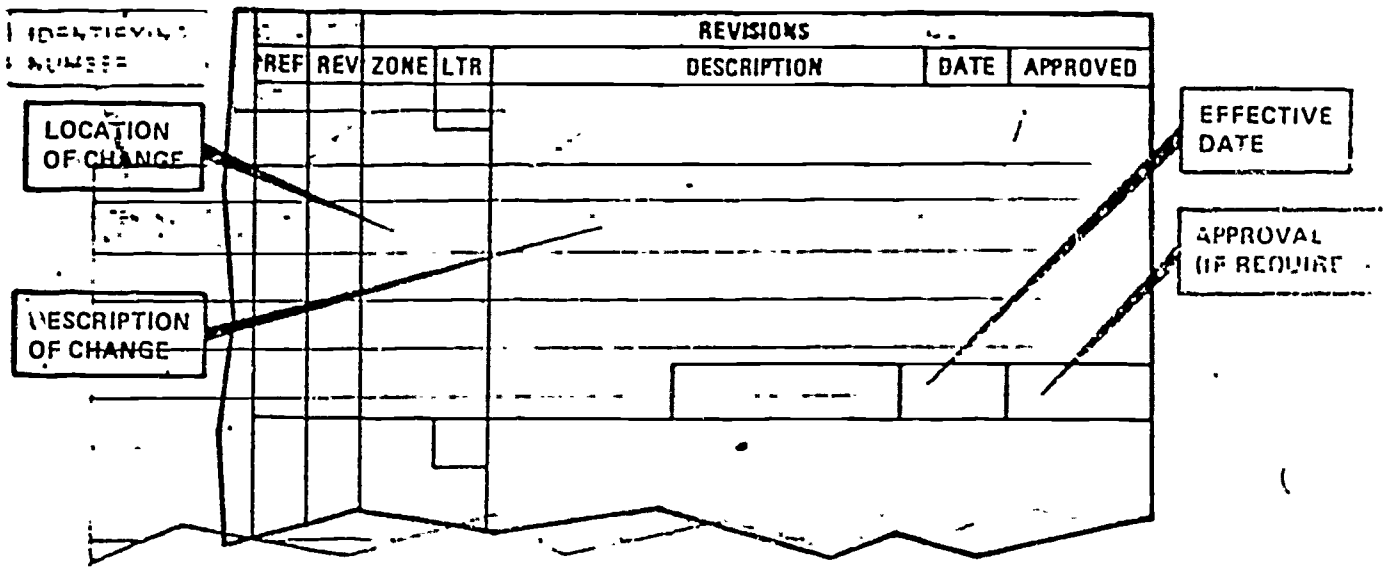
Each block or section of the drawing contains a specific type of information. The major blocks are shown on the following pages.

I. TITLE AND APPLICABILITY BLOCKS

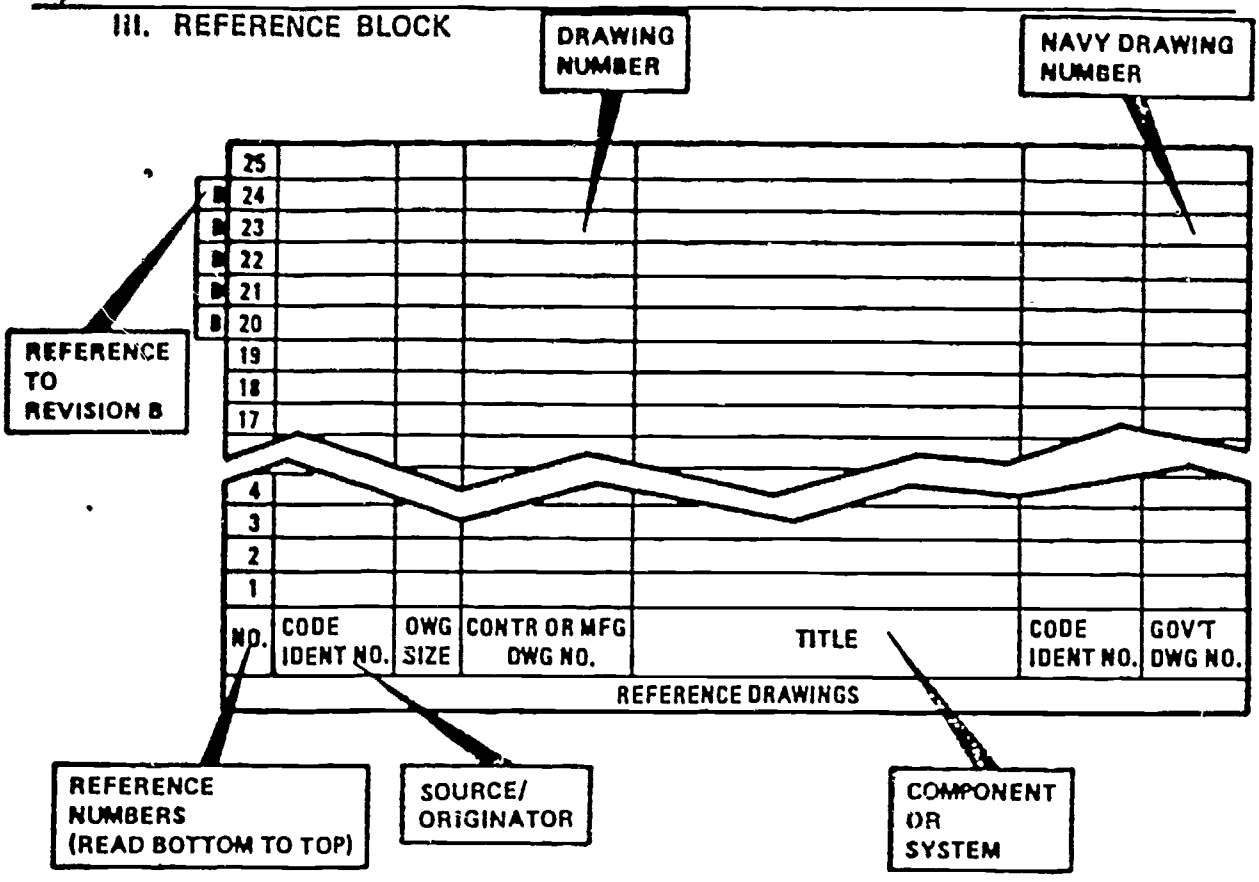


*Reproduced or reduced drawings often have slight size variations because of the print-making process, therefore, use the dimensions already given on the drawing to figure out unmarked dimensions. Do NOT use the drawing scale and a ruler.

II. REVISION BLOCK



III. REFERENCE BLOCK



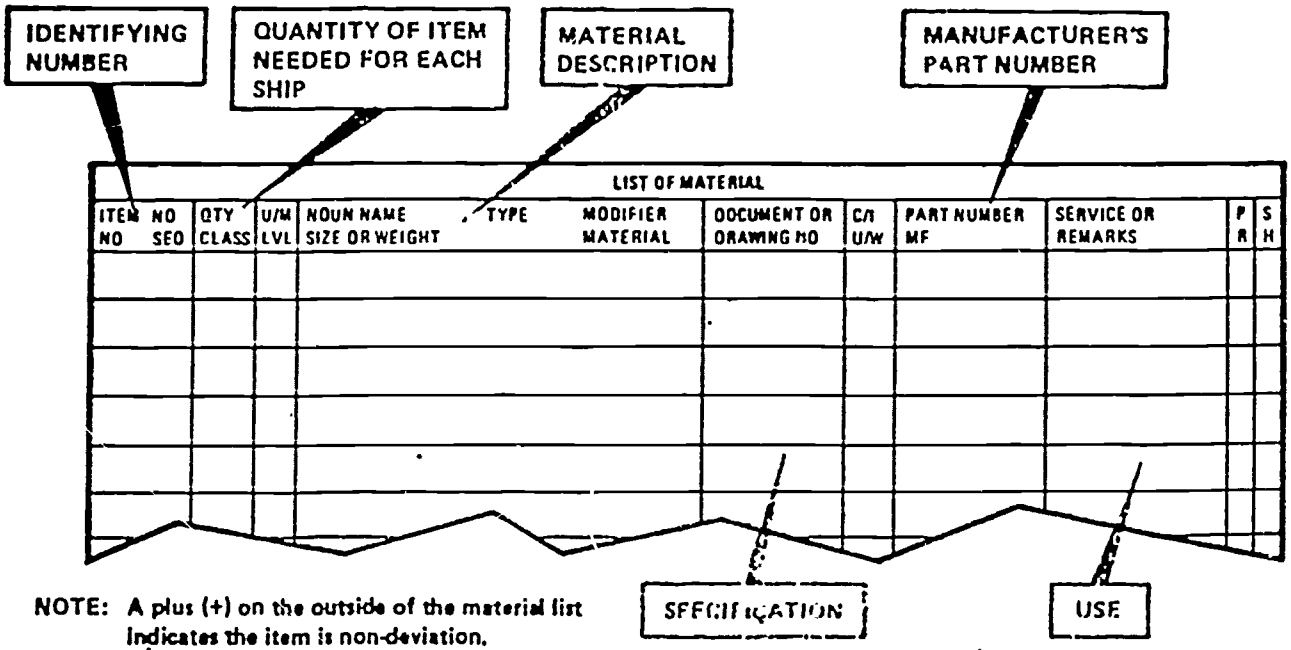
IV. NOTES

For the most part this block details procedures, specifications, and symbols.

Example:

8. Items marked "I" in the "LVL" (MIC Level) column shall comply with the Level I Material Identification (Marking), Inspection, Material Testing, Procurement and Documentation requirements of NAVSHIPS 0948-045-7010.

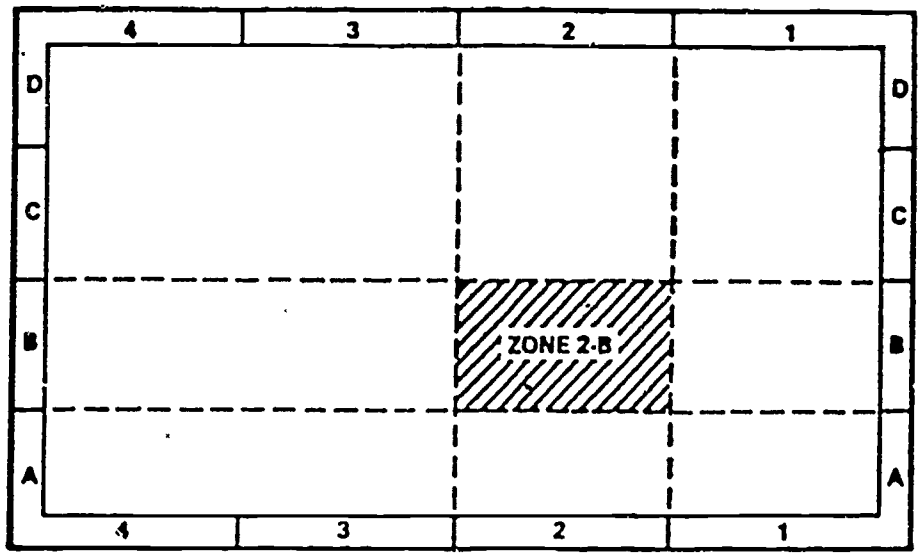
V. LIST OF MATERIAL



NOTE: A plus (+) on the outside of the material list indicates the item is non-deviation.

VI. ZONING

Zoning is a method to locate items on a large drawing. Numbers are evenly spaced along the top and bottom of the drawing and letters are evenly spaced along the sides to make it easier to find information.



Zone 2-B, for example, is the area where 2 and B intersect.

NOTE: A panel is a drawing area that is defined by using zones. For example, panel 2, as shown above, comprises zones 2A, 2B, 2C, and 2D.

BLUEPRINT FORMAT

1. The letter which indicates the latest change on a drawing is found where? What is it called?

2. Where is a description found of each change made on a drawing?

3. Where would the reference and drawing numbers of supplemental blueprints found?

4. What does a letter and number in a block, such as $\boxed{D_4}$, mean next to a reference in the reference block?

5. Where would an explanation of a special symbol such as  , be found a drawing?

6. Where are the dimensions for a specific piece listed?

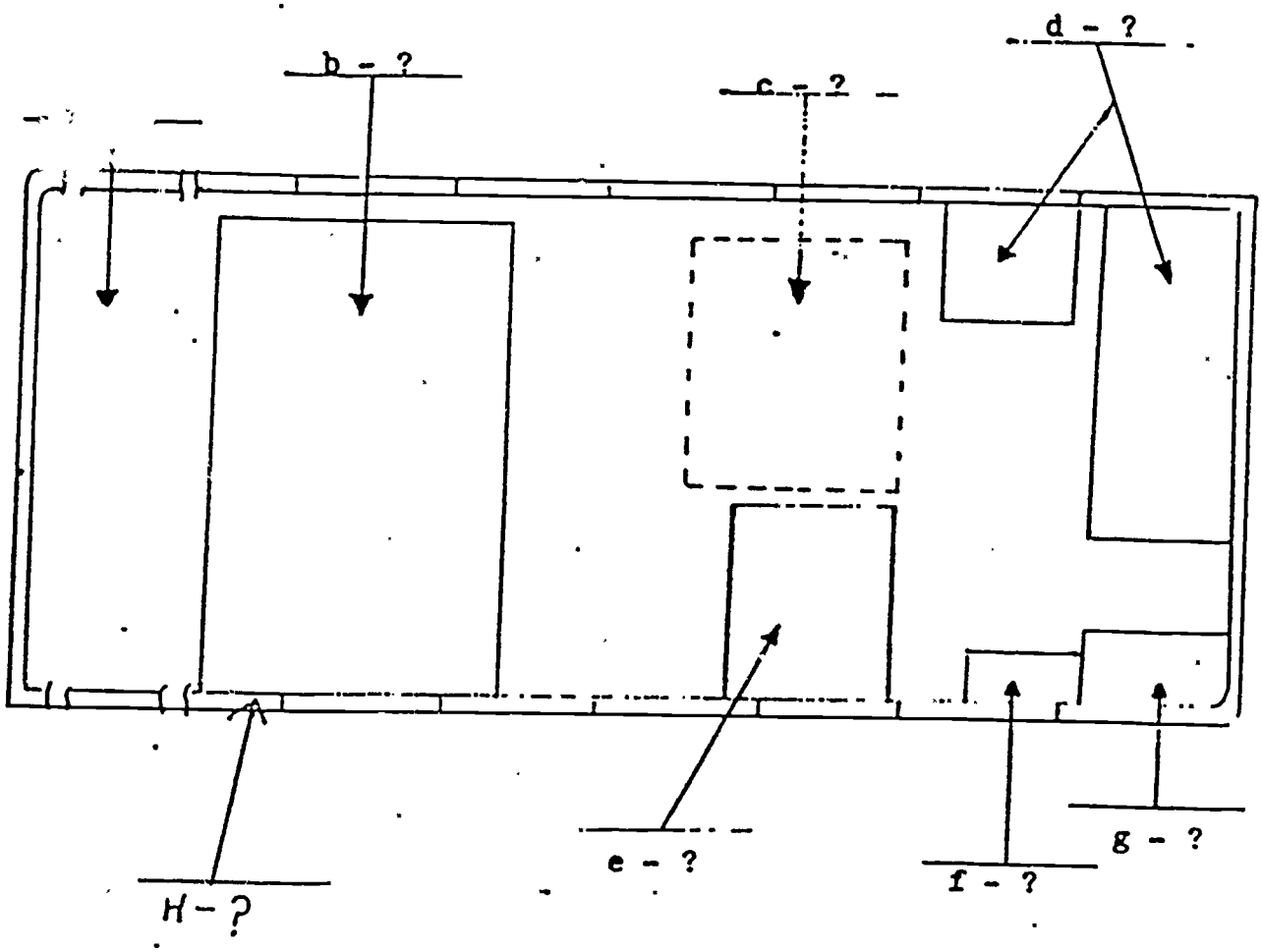
7. Why must you not use a ruler and a scale indicated on a drawing to figure out an unmarked dimension? What must be used instead?

8. Using the attached diagram identify the blocks shown, for answers a - h.

   a.)
   b.)
   c.)
   d.)
   e.)
   f.)
   g.)
   h.)

BLUEPRINT FORMAT

Place all answers under question number 8.



MASTER LESSON PLAN

I. COURSE TITLE - PH1 _____ LESSON NUMBER - _____

Name of Instructor _____ Day/Period Taught _____

II. OBJECTIVES OF LESSON :

To make the apprentice aware of the various tolerances used in pipehanger construction.

III. PRESENTATION

A. Discuss Pipehanger Tolerance E.N. Books
(688 & Trident Class)

B. Encourage discussion of working problems

C. Remind students of E.N. applicability

IV. TESTS

None

V. MATERIALS

Pipehanger Assembly E.N. Books
(688 & Trident)

VI. REFERENCES

Pipehanger Assembly E.N. Books

MASTER LESSON PLAN

I. COURSE TITLE - PH - 1 LESSON NUMBER - _____

Name Of Instructor _____ Day/Period Taught _____

II. OBJECTIVES OF LESSON :

To instruct the apprentice in the proper use of Temporary Pipe Supports to facilitate Pipehanger Installation.

III. PRESENTATION

A. Placement Of Temporary Supports

1. Care should be taken as to make certain that when temporary supports are installed, they cause no undue stress on the piping they are supporting, and do not conflict with the installation of permanent pipehangers.

B. Use Of Temporary Supports

1. Temporary supports are only to be used to provide support from the natural sag of a pipe and not to be used to "pull" a pipe on location.

2. If so called "adjustable" hangers are needed to move a pipe to it's proper location and it is a resiliently mounted system, serious problems may result, for example:
(The following example shows the formula for calculating the amount of force required to move a 2" carbon steel pipe 8 feet long 3inches to maintain a square fit-up.)

USE H/O

B. (cont.)

3. Prior to the installation of permanent hangers it is neccesary to loosen the temporary pipe supports to insure that there is no cold spring on the pipe. If the amount of cold spring is great enough to move the pipe off location to the point where clearances cannot be maintained the pipe must be re-worked to alleviate that amount of spring. When relieving the tension on temporary pipe supports care must be taken to insure personal safety.

REMEMBER: Some pipes are installed using 1-ton come-a-longs!

IV. TESTS

V. MATERIALS

H/O PIPE DISPLACEMENT

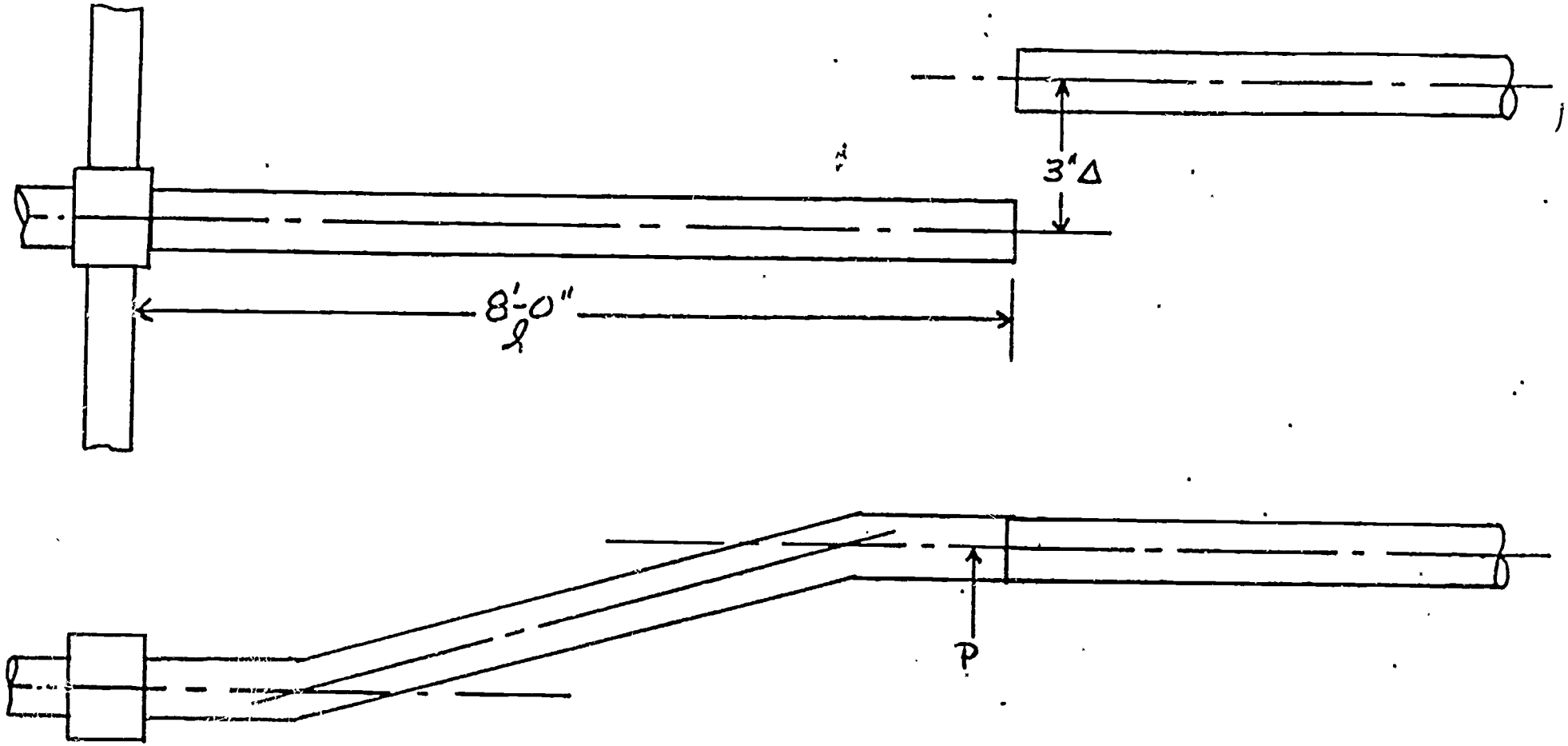
VI. REFERENCES

NONE

PIPEHANGER APPRENTICESHIP TRAINING

HANDOUT PIPE DISPLACEMENT

EXAMPLE: Force Required To Displace A Pipe While Maintaining Squareness Of Ends.



2" Carbon Steel Pipe 2.375" X .154"

For Carbon Steel E (Modulus Of Elasticity) = $30X10^6$

I (Moment Of Inertia Of This Pipe) =.666

Weight Per Foot With Fluid = 5lbs.

Assuming 8'-0" hanger spacing, each hanger will support 40# of pipe/fluid. The mounts would be specified as 50# M.I. mounts.

Calculating P* (Force required to displace pipe as shown):

*NOTE: This is also the force required to maintain the pipe on it's displaced location.

$$P = \frac{3EI\Delta}{\ell^3} = \frac{3(30 \times 10^6)\ .666\ (3)}{96^3} = \frac{179.82 \times 10^6}{.8847 \times 10^6} = 203\#$$

Since the force required to hold the pipe on location is more than four times the rated load of the mounts used, the mounts will be overloaded when the temporary pipe supports are removed. In order to provide mounts to accomodate this spring, 450# mounts would have to be used to support a mere 40# of static load. This problem is magnified when stiffer (larger or heavier wall) piping is used, or when the Δ ~~or~~ amount of spring is greater, or when a very small pipe with ... rated low rated (15#) mounts are used.

The problem when stiffer or larger pipe is sprung is obvious from the above example, since the force required will increase as a function of the stiffness.

For the case of the small (1/2) pipe with 15# M.I. mounts this problem is not as obvious since the force required to overload the mounts can be applied with very little effort. "Corrections" to piping that will overload these mounts can be made with as little as 16# of force.

As can be seen from the above examples, the piping should NOT be sprung into place with a force greater than the rated load of the mounts. In fact, the maximum force allowed per the mount installation procedure drawing (2620-286-20) for adjustment of a mount to accomodate spring is 80% of the mount rated load.

This amounts to the following:

For 15#		Mounts	the allowed	force	is 12#
50#					40#
100#					80#
150#					120#
450#					360#
900#					720#

When the spring is upward, the weight of the pipe at the mount location will also need to be accomodated reducing the usable mount adjustment force by that amount. For example, a 50# mount supporting 30# of pipe weight can only exert a 10# vertical force to accomodate pipe spring. If the hanger is "backed-off" to stay within its load range at a point where cold spring is significant, the pipe simply follows the mount until the forces are equalized, resulting in the pipe being off location.

MASTER LESSON PLAN

I. COURSE TITLE - PH 1 LESSON NUMBER - _____

Name Of Instructor _____ Day/Period Taught ____

II. OBJECTIVES OF LESSON :

Upon completion of this lesson the apprentice will be able to identify the various types of Weld Symbols used in pipehanger construction.

III. PRESENTATION

A. Why Weld Symbols Are Used

1. Weld symbols are the quickest and easiest method used to describe a joint.
2. Most widely accepted way of describing a joint on a drawing.
3. The advantages of weld symbols are :
   a. Standardized - Do not vary from draftsmen to draftsmen.
   b. Recognized throughout the steel industry.
   c. Completely define weld that is required :
      Joint Preparation
      Weld Type
      Weld Size
      Contours

B. Elements Of A Weld Symbol

1. Consists Of Three Basic Lines
   a. Reference Line - The line at which all symbols, dimensions and other joint data are placed.
   b. Arrow Line - A line that connects to the reference line and points to the surface(cont)

Cont.1b. or joint to be welded.

* c. Tail - A supplementary line used for special notes and for specification references.
*Note - The tail may be omitted if no special notes are used.

2. Basic Symbol - Symbol is placed midway along the reference line.

a. If placed below the reference line- Weld will be placed on the arrow side or near side of the joint.

b. If placed above the reference line - Weld is to be placed on the other or far side of the joint.

c. If above and below the reference line - Weld will be placed on both sides of the joint.

3. Common Weld Symbols

a. Discuss common weld symbols using handout.

IV. TEST

WELD SYMBOLS

V. MATERIALS

Handout - Weld symbols
Test - Weld symbols

VI. REFERENCES

Mil-Std. 22B

WELD SYMBOLS

INTRODUCTION

The basic weld symbol, Figure 1, consists of a reference line, an arrow, and sometimes a tail. Different items (abbreviations, dimensions, and other symbols) are added to the basic symbol to provide the information needed to make the proper weld.

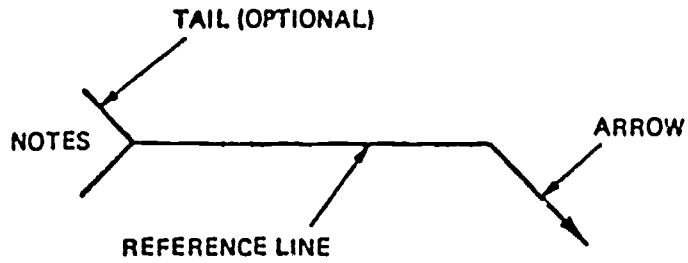
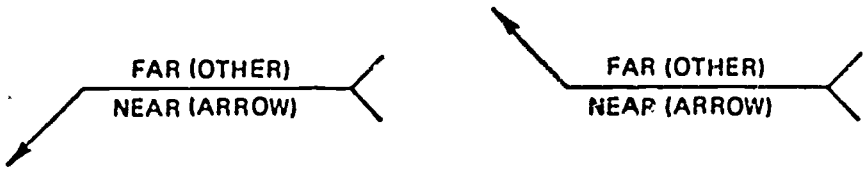


Figure 1. Basic Weld Symbol

The tail is added to the basic symbol when a specification, note, or other reference information must be added to the symbol. This information is place inside the angle of the tail.

The side of the reference line closest to the reader is the near side (arrow side), and the side opposite is the far side (other side). The near and far sides are not determined by the direction of the arrow, as can be seen below



(Near side remains the same, regardless of the change in the direction of the arrow.)

Figure 2. Near/Far Sides

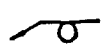
COMMON WELD SYMBOLS


Seam


Bead


Fillet


Plug or Slot


Spot or Projection


Weld-all-around


Flush

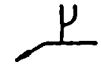
Typical; used when a number of identical welds appear together on a drawing


Double Butt

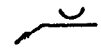

V


Bevel


U


J


Convex


Concave

APPLICATION

When a weld symbol appears on the near side of the reference line, the weld must be made on that side of the joint; if it appears on the side of the reference line away from the reader, the weld is made on the opposite side. Near and far-side applications of a fillet weld appear in Figures 3 and 4.

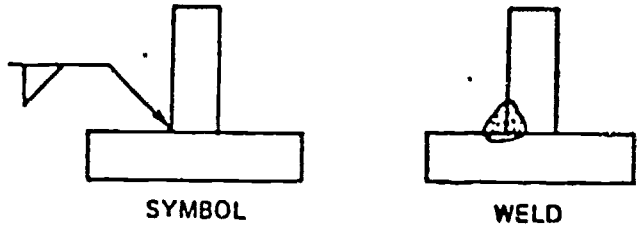


Figure 3. Application of Fillet Weld Symbol - Near Side

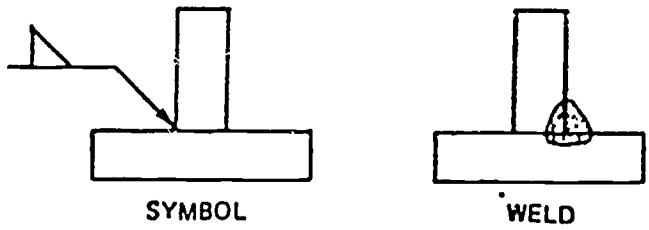


Figure 4. Application of Fillet Weld Symbol - Far Side

MULTIPLE WELD SYMBOLS

When more than one weld is required for a joint, a symbol is shown for each weld. When the weld symbols appear on both sides of the reference line, the welds must be made on both sides of the joint. One-joint and two-joint applications of the fillet weld symbol are illustrated in Figures 5 and 6.

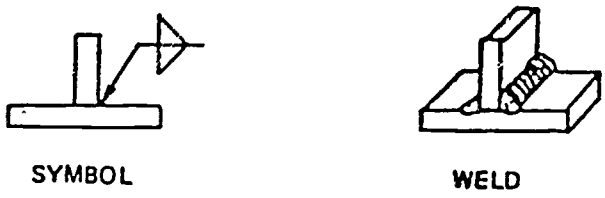


Figure 5. One-joint Fillet Weld

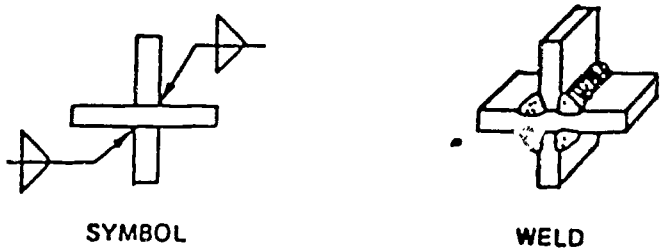


Figure 6. Two-joint Fillet Weld

WELD-ALL-AROUND SYMBOLS

Welds which go all around the joint are indicated by placing the weld-all-around symbol ○ at the bend of the reference/arrow line. An example appears in Figure 7.

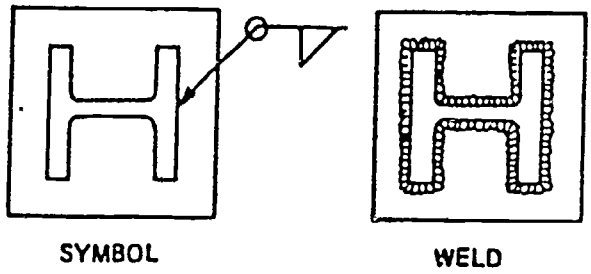


Figure 7. Application of Weld-all-around Symbol

DIMENSIONS

Dimensions found on weld symbols may indicate size, strength, length, pitch (center-to-center spacing between welds), or the number of welds. The location of the dimensions is determined by the side of the reference line on which the weld symbol is placed. Figure 8 shows the dimension location for both sides of the reference line; Figure 9 gives examples of dimensions applied to typical weld symbols.

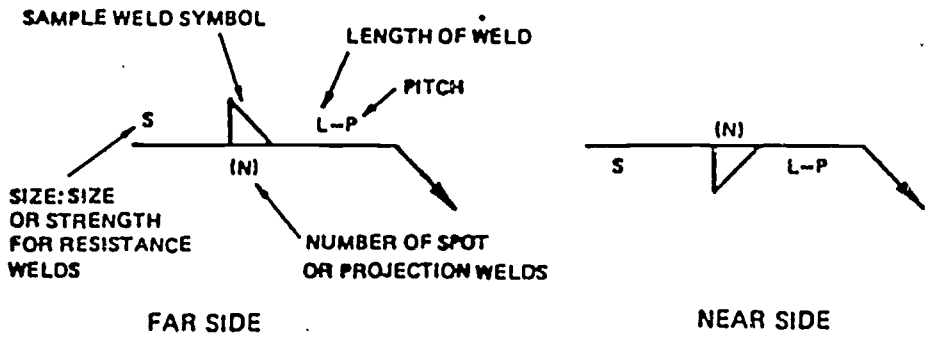


Figure 8. Location of Dimensions

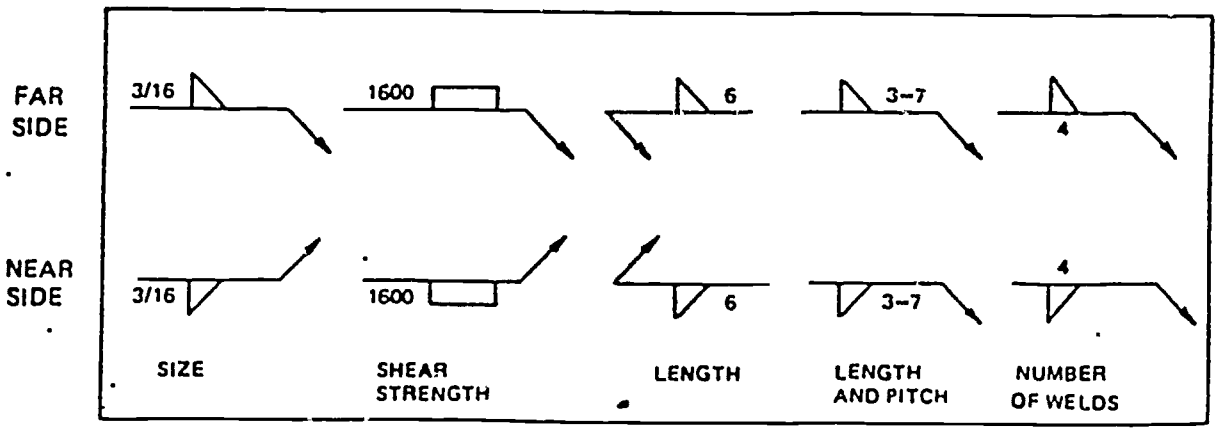
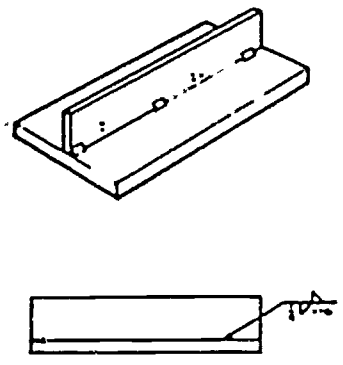
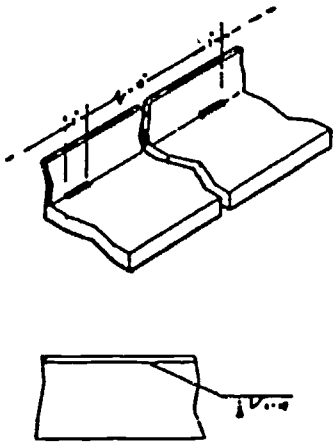


Figure 9. Typical Dimension Applications

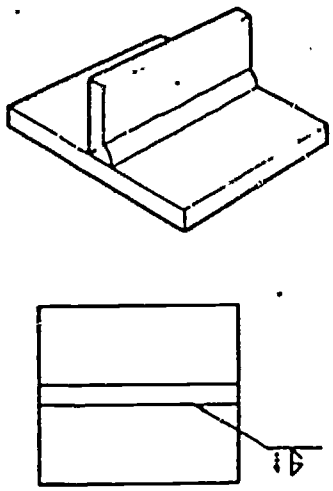
EXAMPLES OF COMMON WELD SYMBOLS (Cont'd)



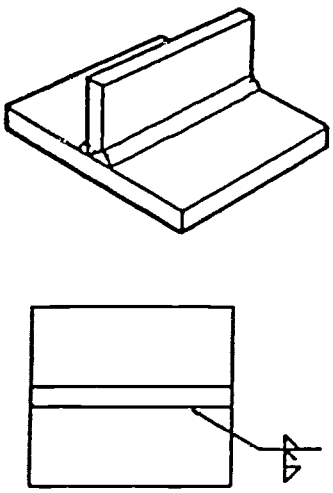
1/4 Fillet, Staggered
Length 1"; Pitch 6"



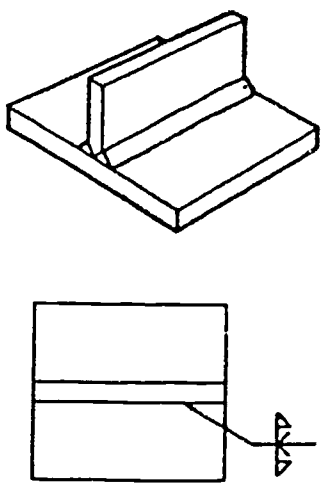
1/8 Fillet Weld, Near
Side; Length 1"; Pitch 12"



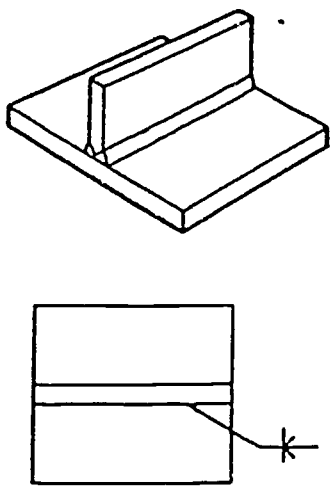
1/4 Single Bevel,
Fillet, Near Side



Single Bevel & Fillet,
Near Side; Fillet,
Far Side

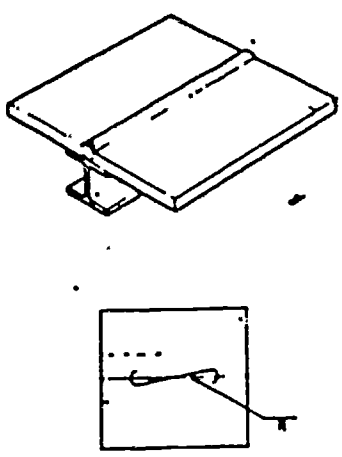


Double Fillet & Bevel,
One Piece

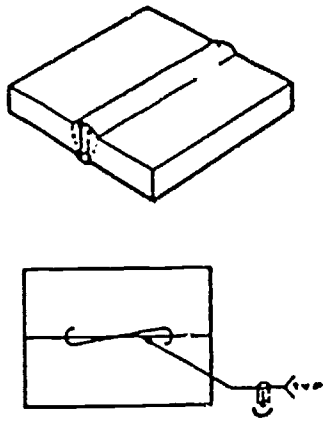


Double Bevel,
One Piece

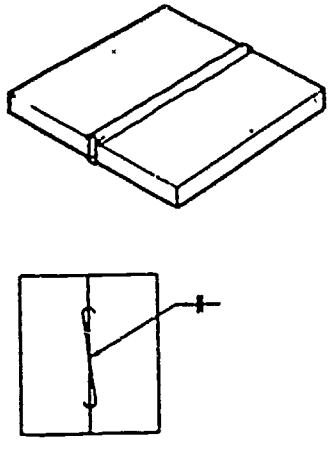
EXAMPLES OF COMMON WELD SYMBOLS (Cont'd)



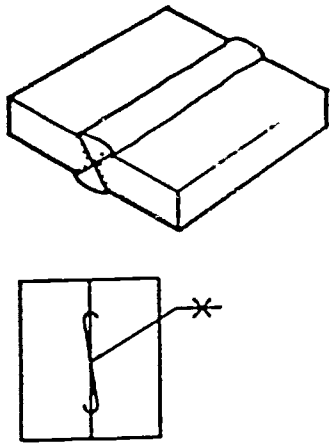
Single Butt Weld,
Near Side



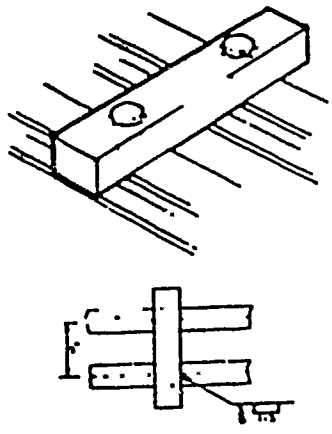
Single Butt Weld,
1/8 Root Opening
Near Side, Over Flush (Convex)
Far Side, One Bead



Double Butt Weld



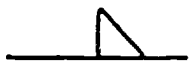
Double V Weld

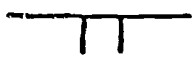


3/8 Plug Weld;
Diameter 1"
Pitch 3"

NAME _____ DATE _____

IDENTIFY THE FOLLOWING WELD SYMBOLS

1. 

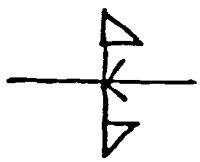
2. 

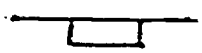
3. 

4. 

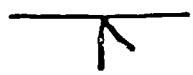
5. 

6. 

7. 

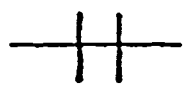
8. 

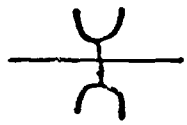
9. 

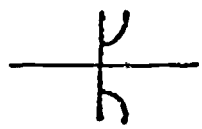
10. 

11. 

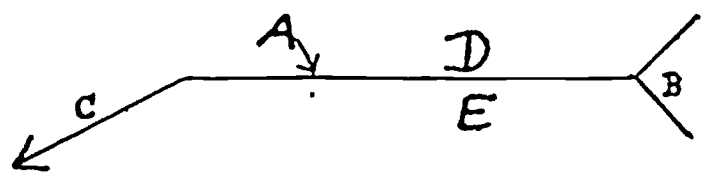
12. 

13. 

14. 

15. 

16. 



A _____

B _____

C _____

D _____

E _____

I. COURSE TITLE PH 1 LESSON NUMBER

Name of Instr. Day/Period Taught

II. OBJECTIVES OF LESSON:

To make the apprentice knowledgeable in types of materials and plate conversions used in submarine construction.

III. PRESENTATION:

A. Types of Steel - Use, how specified, and color code

1. HY80

The HY stands for high yield and the 80 indicates a yield strength of 80,000 pounds per inch. The yield strength is defined as the stress at which a marked increase in deformation occurs without an increase in load. It has a tensile strength (the greatest longitudinal stress a substance can bear without tearing apart.) sometimes referred to as the ultimate strength, between 105,000 and 110,000 pounds per square inch.

a. Color Code Identification - Entire plate is painted BROWN.

b. Welding Color Code - Using a brown color code crayon, place a brown stripe approximately 2 inches away from the joint to be welded to identify the steel.

2. HTS - High Tensile Steel

There are two types of HTS used in the shipyard. HTS generally possesses a minimum tensile strength of about 70,000 pounds per square inch and a corresponding minimum yield strength of about 55,000 pounds per square inch. One type of high tensile steel used has a yield strength of between 50,000 to 70,000 pounds per square inch and is referred to as TS. The second type of high tensile steel used has a tensile strength between 70,000 to 90,000 pounds per square inch and is referred to as carbon maganese or CMN.

a. Color Code Identification - The entire plate is painted either light green, dark green, or in the case of CMN, yellow-green.

b. Welding Color Code - Using a green color code crayon, place a green stripe approximately 2 inches away from the joint to be welded.

3. MS - Mild Steel

Mild Steel is one of the metals that is used. It has a typical yield strength of 38,000 pounds per square inch and a tensile strength of 65,000 pounds per square inch.

a. Color Code Identification - Entire plate is painted yellow.

b. Welding Color Code - Using a green color code crayon, place a green stripe 2 inches away from the joint to be welded regardless of plate color.

B. Material Thicknesses

1. Use handout

IV. Tests

Structural Materials

V. Materials

Handout : Thickness & Plate Weight

Quiz : Structural Materials

Pocket Card: Color Code Chart

1. Types of steel. Use, how specified, and color code.

A. HY-80

The HY stands for high yield and the 80 indicates a yield strength of 80,000 pounds per square inch. The yield strength is defined as the stress at which a marked increase in deformation occurs without an increase in load. It has a tensile strength,* sometimes referred to as the ultimate strength, between 105,000 and 110,000 pounds per square inch. This type of steel must be preheated prior to welding (including tack welding) to a temperature of 200°F.

*tensile strength: The greatest longitudinal stress a substance can bear without tearing apart.

1. Uses: The entire pressure hull, internal frames, some bedplates, major internal tanks, (hard tanks) some foundations, structural bulkheads.

2. Specified on blueprints by either thickness or by weight.

3. Color code identification: the entire plate is painted BROWN.

4. Welding color code: using a brown color code crayon, place a brown stripe approximately 2" away from the welded joint to identify the steel as HY-80 if brown painted surface is not visible. However, HY-80 that is painted with its original identifying color does not require the color coded stripe.

5. Temporary attachments are to be removed by grinding, burning or gouging and any resulting weld scars to be ground smooth.

6. HY-80 must be allowed to air cool following burning or welding or any other hot work.

7. The substituting of materials for HY-80 is prohibited.

B. HTS

There are two types of HTS used in the shipyard. HTS generally possess a minimum tensile strength of about 70,000 lbs per square inch and a corresponding minimum

B. Yield strength of about 55,000 lbs per square inch. One type of high tensile steel used at EB has a yield strength of between 50,000 - 70,000 lbs per square inch and is referred to as TS. The second type of high tensile steel used commonly on the 688 Class, has a tensile strength between 70,000 and 90,000 lbs per square inch referred to as carbon manganese. (CMN)

1. Uses: Non-structural bulkheads, non-pressure hull foundations, decking, superstructure, angle stock, flat bar, etc.

2. Specified on blueprints according to a thickness or by weight.

3. Color code identification: The entire plate is painted either light green, dark green, or in the case of CMN, yellow-green.

4. Welding color code: Using a green color code crayon, place a green stripe approximately 2 inches away from the joint to be welded to identify the steel as being HTS if the green painted surface is not visible. However, HTS or CMN that is painted with its original identifying color does not require the color code stripe.

C. MS: Mild steel is one of the metals that is used, it has a typical yield strength of 38,000 lbs/sq" and a tensile strength of 65,000 lbs/sq".

1. Uses: Nonstructural bulkheads, angle stock, channel stock, decking fans, flat bar.

2. Specified on blueprints according to a thickness or by weight.

3. Color Code identification - the entire plate is painted yellow.

4. Welding color code: Using a green color code crayon, place a green stripe 2" away from the welded joint regardless of the original identifying color.

Note: MS is sometimes referred to as MW (Mild weld).

D. CRES: Corrosion resistant steel is a type of stainless steel. Stainless steels are categorically described by composition as containing 4% or more chromium and containing more than 50% iron. They also may contain alloying additions such as nickel, molybdenum, and others to enhance their corrosion resistance, scaling resistance and mechanical properties.

D. 1. Uses: Limited to special systems with a different type of CRES being used in most cases, for each system, i.e., nuts, bolts, flat bar, plating, angle stock, washers.

2. Specified on blueprint by thousandths up to 1/8 of an inch.

3. Color Code; Normally unpainted plate is a dull silver-gray. The different types are distinguished by numbers that are printed on the metal.

4. Welding color code: Using a white color code crayon (designator), write the type of stainless being welded.

E. Galvanized Plate - a zinc coating applied to steel for corrosion resistance properties. The plate properties are those of the particular steel being galvanized.

1. Uses: Grating walkways, hangers, ballast tank ladders. Most items are sent out to be galvanized.

Note: A. HY80 is never to be galvanized.

B. Galvanization must be ground away to least 2" prior to any welding or burning because of the toxic vapors that are produced.

F. Aluminum - much of the aluminum used throughout the shipyard is used by the sheetmetal department for ventilation systems. lockers, and cabinets. The aluminum used by shipfitters primarily consists of 3/8" non-skid aluminum plate for portable decking plates.

G. Thicknesses of structural materials specified on blueprints should never be substituted with thinner thicknesses.

THICKNESS (INCHES)	THICKNESS (DECIMAL)	THICKNESS (688 DECIMAL)	WEIGHT (LB/SQ FT)
1/16	.0625		2.55
1/8	.125		5.1
3/16	.1875	.19	7.65
1/4	.250		10.2
5/16	.3125	.32	12.75
3/8	.375	.38	15.3
7/16	.4275	.44	17.85
1/2	.500		20.4
9/16	.6125	.57	22.95
5/8	.625	.63	25.5
11/16	.6875	.69	28.05
3/4	.750		30.6
13/16	.8125	.82	33.15
7/8	.875	.88	35.7
15/16	.9375	.94	38.25
1	1.000		40.8

CONVERTING WEIGHT TO THICKNESS

(LBS TO INCHES)

WEIGHT OF STEEL PLATE DIVIDED BY 5.1 = THICKNESS OF STEEL PLATE

EXAMPLE:

WHAT IS THE THICKNESS IN INCHES OF 20.4# PLATE?

20.4# ÷ 5.1 = 4

NOW TAKE THE 4 AND PUT IT OVER 8, 4/8 = 1/2

YOUR ANSWER IS 1/2"

QUIZ
STRUCTURAL MATERIALS

Name _____

Date _____

1. Carbon Maganese steel used on some 688 class construction is a type of:

   a. HY-80
   b. Mild Steel
   c. HTS
   d. CRES

2. Prior to welding HY-80 must be (2 answers)
   a. ground free of paint, rust, and mill scale
   b. preheated
   c. color coded green
   d. M.P. tested

3. When welding Mild Steel to unpainted HTS, the MS must be color coded _____, and the HTS must be color coded _____.

4. The color code stripe must be approximately _____ inches from the weld seam.
   a. 1 inch
   b. 2 inches
   c. 2 ½ inches
   d. on the seam itself

5. Steel plate thickness may be specified on a drawing in several ways. Give Two.

6. True or False. HTS or HY-80 that is painted with it's original identifying color must be color coded.

7. Most tubing and flat bar used in hanger construction is made from this type of steel.
   a. HTS
   b. CRES
   c. HY-80
   d. Monel

8. HTS stands for what three words ?

9. Seven square feet of ½" thick plate weighs ?
   a. 35.7#
   b. 142.8#
   c. 20.4#

10. Convert the following plate weights to fractions of an inch.
   a. 30.6#
   b. 22.95#
   c. 45.9#
   d. 10.2#

MASTER LESSON PLAN

I. COURSE TITLE PH - 1 LESSON NUMBER _____

NAME OF INSTRUCTOR _____ DAY/PERIOD TAUGHT _____

II. OBJECTIVES OF LESSON

To instruct the apprentice in the proper use of the Shipyard Work Statusing System (SWSS)

III. PRESENTATION

A. Discuss handout provided.

VT Card B. Using Page 2 of the handout discuss the following procedures:

1. Hanger Plan Revision, Arrangement Drawing and Revision, and Engineering Notice Revision (if applicable).

   This information to be filled in by either Lead Trade Foreman or Pipehanger personnel working the hanger.

2. Remarks area - This area is used for weld procedures or symbols and for special instructions or symbols and for special instructions if required.

3. Upon receiving hanger assembly from warehouse personnel this is used to record when and to whom the hanger was issued.

4. L/T FRMN - Supervisor's signature stating that hanger is installed.

5. WLD FRMN - Welding Foreman's signature signifying hanger is welded to proper procedures, size is correct, weld is cleaned (VT welds only require wire brushing of weld) and ready for inspection. This block can also be signed by L/T foreman possessing the proper certification.

6. Inspection Area - These blocks are reserved for inspectors use. If hanger is found to be satisfactory in all respects inspector will sign name and badge number in top portion of block. If hanger is found to be unsatisfactory, inspector will enter a "kick" number in kick code area. Rejection Document is used for Unsat numbers or CFE numbers as required. Cut block is used to identify cut chit number.

COURSE TITLE PH - 1 LESSON NUMBER

MT Card C. Using Page 4 of the handout outline the procedures used for the MT SWSS Card 1-4. These areas are used for the same type of information found on the VT SWSS card.

5. Heat Off - Weld foreman must fill in signifying when heat was removed from welding area. i.e., removal of strip-heaters or localized preheat such as torch.

   At Ambient - This block is filled in with time stating that welded area has cooled to surrounding temperatures. (Note: Welding foreman will not sign-off until joint or joints are cleaned and signed off by Grinder foreman.

6. GRND BKG MT - If weld joint requires backgrind this area must be signed by grinder foreman.

7. MT Method - Denotes method used, whether prods or yoke and gives serial number of unit used.

   MT Due Date - Gives date when MT was performed.

   MT Footage - Gives length of weld inspected (If 3" x 3" square tube was welded MT footage would be approximately 12")

   Final MT Sat - If weld is MT and found to be satisfactory, MT inspector will sign name and badge number and date inspected.

   Final VT Sat - If hanger is found to be satisfactory in all areas such as materials, location, and tolerances VT inspector will sign name, badge number, and date signifying as hanger being complete.

   Kick Code - Used only if hanger is found to be unsatisfactory.

D. Kick Codes

1. Discuss different codes used and ways to avoid these problems. Codes are on last page of handout.

E. Reasoning for SWSS System

1. This system is used to trace, in out case, hangers from their issue, to installation, to inspection. In the past different areas maintained seperate systems, with the advent of the SWSS system every type of hanger used on submarines, pipehangers, ventilation hangers and electrical hangers now use the same system and use the same procedures, thus making it much easier to track the progress of construction installation and acceptance.

COURSE TITLE _____ LESSON NUMBER _____

IV. TESTS

V. MATERIALS

Copies of SWSS Cards MT and Vt

Handout: Shipyard Work Statusing System SWSS Card Procedure

VI. REFERENCES

SWSS Procedure 2-2

The SWSS card is a computer generated non-nuclear NDT/VT inspection document (Job Ticket) used to capture QA Inspection signatures and trade signatures as required.

SWSS CARD

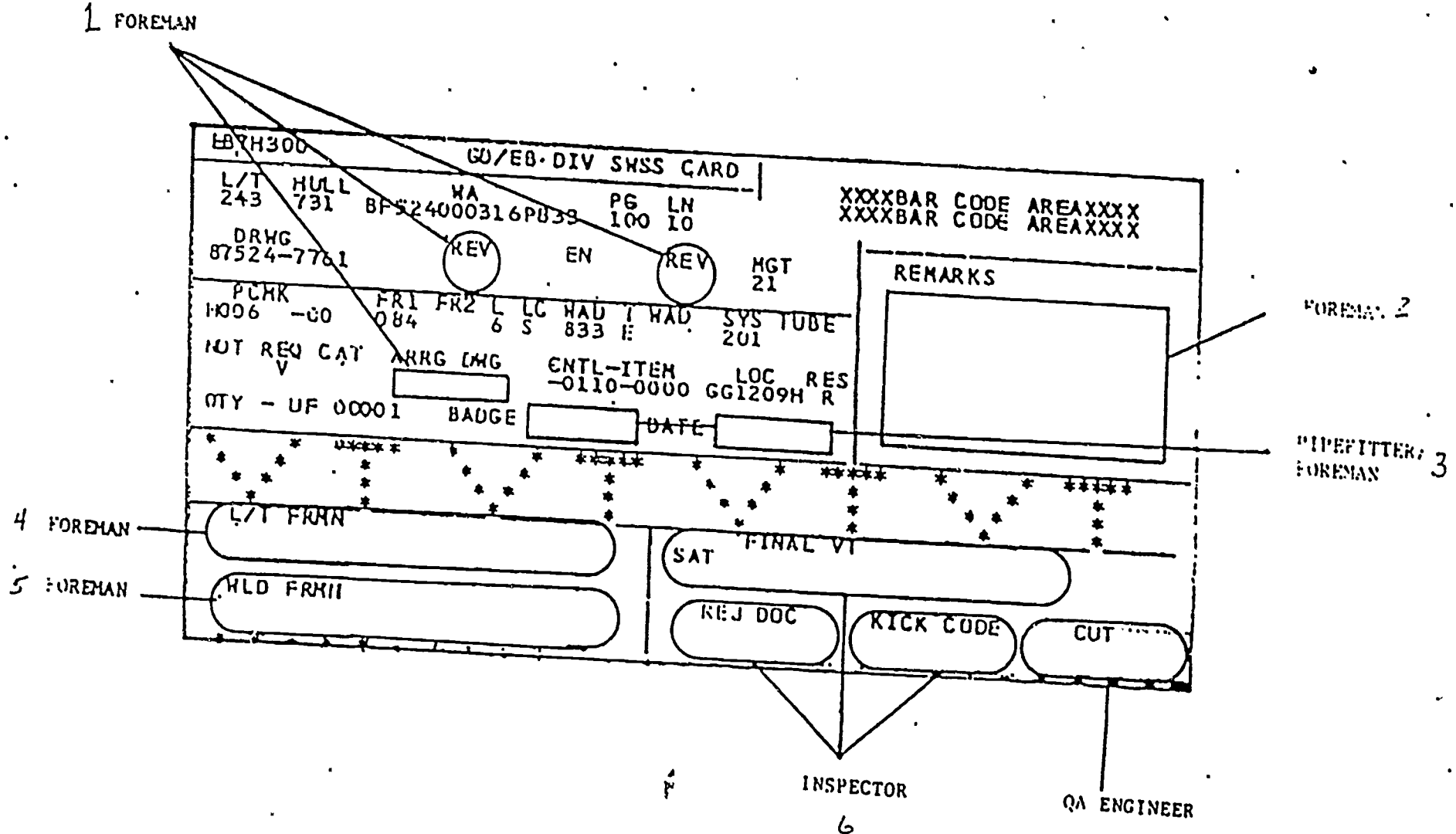
FIVE-PART INSPECTION DOCUMENT/JOB TICKET:

- YELLOW COPY - Used to request material by lead trade foreman.
- RED COPY - Forwarded to trade clerk to update hanger fit-up status.
- BLUE COPY - Forwarded to trade clerk to update hanger weld status, used to request weld by lead trade foreman.
- GREEN COPY - Trade copy of sat inspection maintained by trade clerk.
- WHITE COPY - Division record of sat inspection maintained by QA records.

SWSS CARD AVAILABLE IN TWO FORMATS:

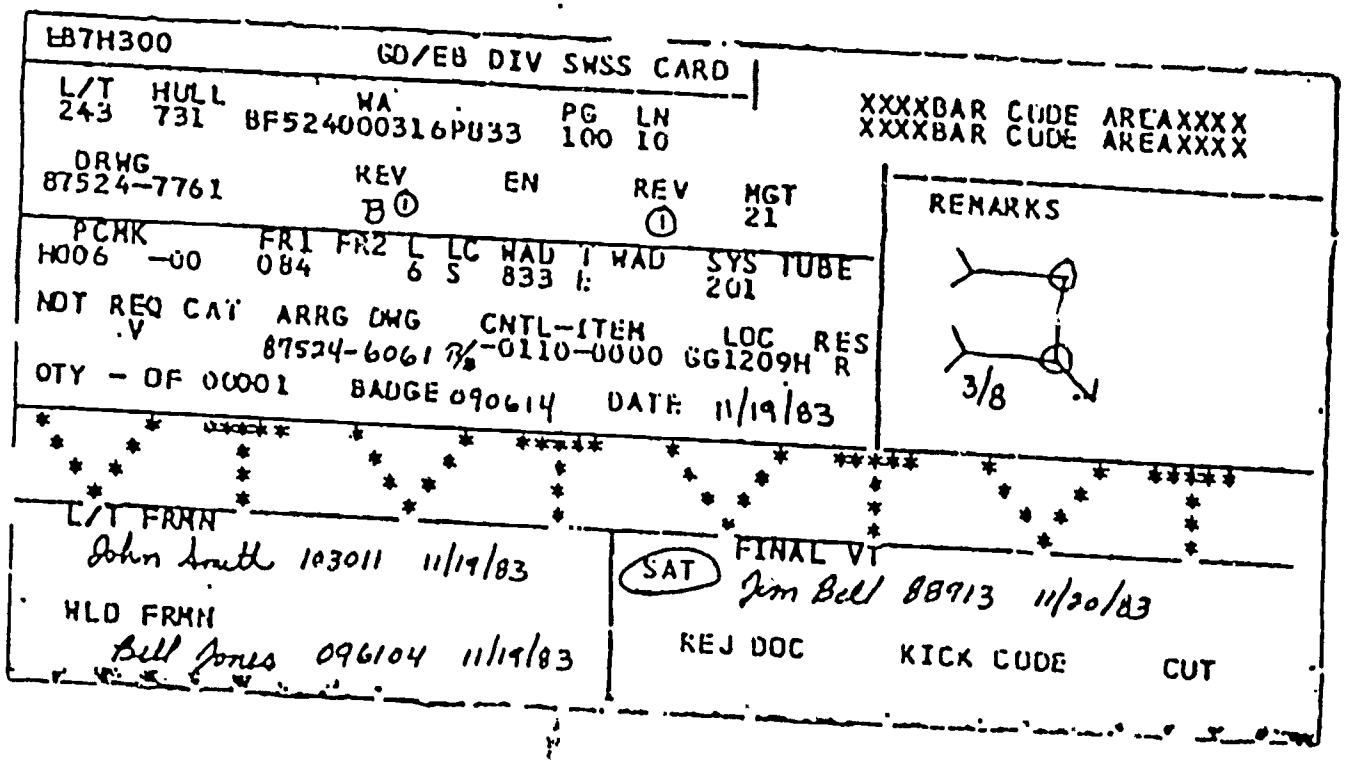
- MT
- VT

VT SWSS CARD


1 FOREMAN
EB7H300
GD/EB-DIV SWSS CARD
L/T 243
HULL 731
WA BFS2400316P039
PG 100 LN 10
XXXXBAR CODE AREAXXXX
XXXXBAR CODE AREAXXXX
DRWG 87524-7761
REV
EN
REV
MGT 21
REMARKS
PCHR H006 -GO
FR1 084
FR2 L 6 LC S
HAD I 833 HAD E
SYS TUBE 201
NOT REQ CAT V
ARRG DWG
ENTL-ITEM -0110-0000
LOC GG1209H
RES R
QTY - UF 00001
BADGE
DATE
2 FOREMAN
3 PIPEFITTER FOREMAN
4 FOREMAN
L/T FRMN
FINAL VT
SAT
5 FOREMAN
HLD FRMN
REJ DOC
KICK CODE
CUT
INSPECTOR
6
QA ENGINEER
7

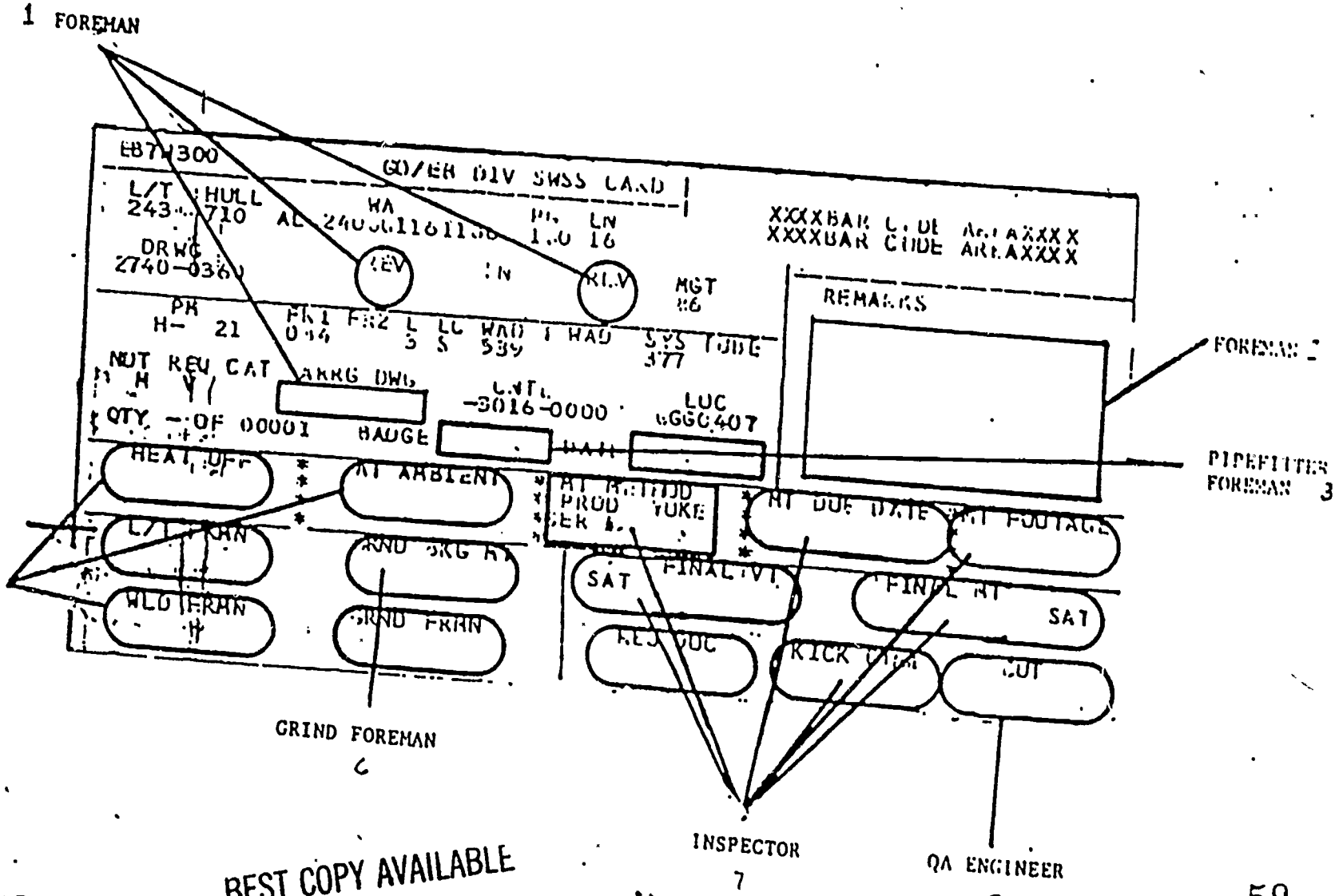
EXAMPLE 2

COMPLETED VT SWSS CARD



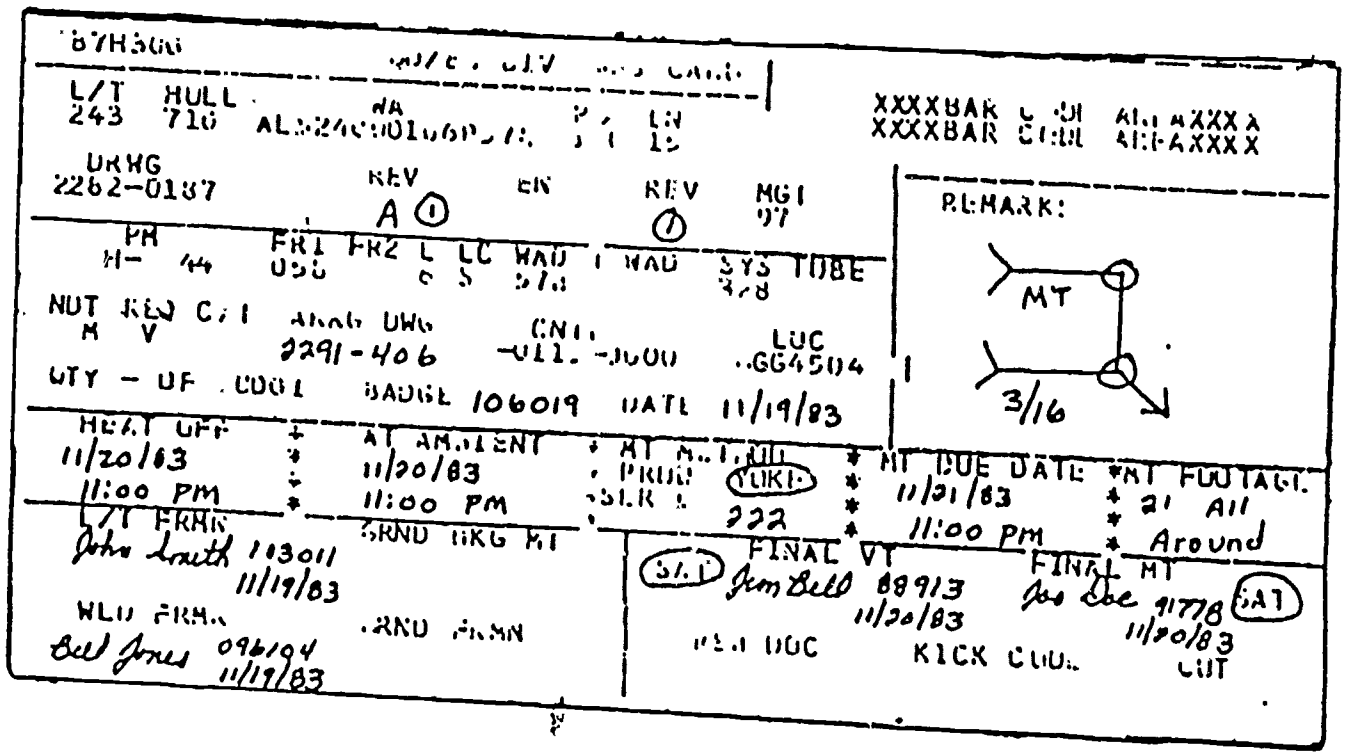
NOTE: See Procedure 2-2 (Procedure for Shipyard Work Statusing System (SWSS) Card) for instructions.

MT SWSS CARD



EXAMPLE 1

COMPLETED MT SWSS CARD



NOTE: See Procedure 2-2 (Procedure for Shipyard Work Statusing System (SWSS) Card for instructions.

SWSS CARD FLOW

RESPONSIBILITY OF SUPERVISOR AND TRADESPERSON

YELLOW CARD	Will be given to warehousemen for hanger issue. Bring plans to ensure your receiving the proper material. Do not except any hanger material that is not a complete.
RED & BLUE COPY	The supervisor is responsible to give copies to service trades for action. Make sure fit up is per plan before supervisor submits copies.
GREEN COPY	Is for department inspection records. Make sure all signatures are present from service trades before requesting inspection.
WHITE COPY	When all necessary signatures have been completed by all related trades, return copies to supervisor, only then the job will be considered complete.

ADDITIONAL INFORMATION

Tradesperson is responsible for the condition of the SWSS card.

Supervisor is responsible for handing out SWSS cards.

DEFIENCY CODES

"KICK CODES"

11. Incorrect Drawing No.
12. Incorrect Revision
13. Form Not Legible
14. Overwrites
15. Not Installed
16. Installation Incomplete
17. Off Location
18. Incorrect Type Hanger
19. Incorrect Orientation
20. Incorrect Material (Type)
21. Incorrect Material (Size)
22. Incorrect Resilient Mount(type)
23. Incorrect Resilient Mount(size)
24. Mount Rod Misaligned
25. Clearance (Hanger/Structure)
26. Clearance (Pipe/Structure)
27. Cleaning Required
28. Other (Specify)
29. Not Welded
30. Weld Incomplete
31. Weld Size
32. Grind Required
33. Slag
34. Spatter
35. Undercut
36. Contour Grind
37. Toe-to-Toe
38. Buttering
39. Porosity
40. Re-Entry Angle
41. Temper Bead
42. Arc Strike
43. Lack Of Fusion
44. Separation
45. Gouging
46. Weld Crack
47. Paint On Weld

MASTER LESSON PLAN

I. COURSE TITLE - PH - 1 LESSON NUMBER

NAME OF INSTRUCTOR DAY/PERIOD TAUGHT

II. OBJECTIVES OF LESSON

To instruct the apprentice in the area of Resilient Mount Loading Procedures using Installation and Adjustment/Inspection, gages.

III. PRESENTATION

A. Types of Gages -

1. 50% Installation gage

2. 80% Adjustment/Inspection

B. Use of Gages

1. 50% gage

a. At installation, take 50% gage for the mount should touch both the load flange (loaded portion of the mount) and the mounting plate, when the mount is properly adjusted.

2. 80% gage

a. During final adjustment, the mount may be compressed to no more than 80% of its rated capacity. The 80% load gage shall be used to check that the 80% capacity has not been exceeded

NOTE: Gage must rest flat against the mounting/support plate when measurements are taken. Cocking of the gage will result in inaccurate readings.

C. Discuss handout Resilient Mount Loading Procedures

IV. TESTS

V. MATERIALS

Handout: Resilient Mount Loading Procedures
50% & 80% Compression Gages
Various Resilient Mounts

VI. REFERENCES

E.B. Plan #2620-286-20

HANDOUT: RESILIENT MOUNT LOADING PROCEDURES

General Instructions for Installation

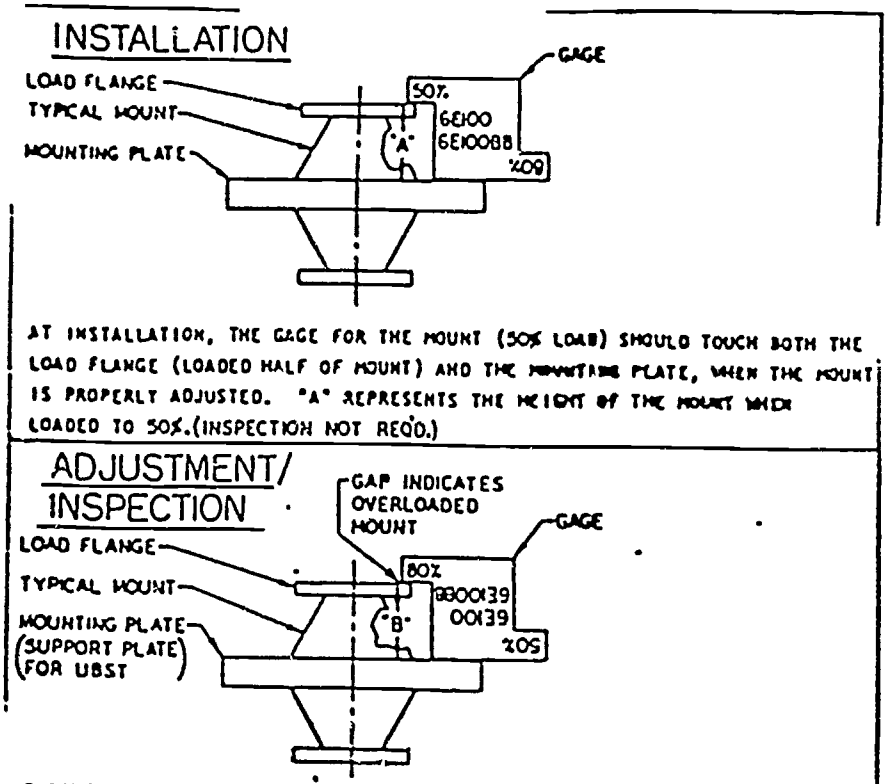
1. Check cure date. Do not install mounts more than seven (7) years old.
2. Replace installation hanger with temporary supports where required. Temporary supports must carry the pipe weight only, and must not impose any cold spring on the piping.
3. Assure that the ends of the piping to which flexible connectors (hoses or risics) are attached, are in their specified locations.
4. Assure that propulsion equipment to which piping is rigidly connected has been supported on its resilient mounts for a minimum of seven (7) days.
5. Secure mount in location as shown on applicable drawing.

The following instructions are for 0# loads only.

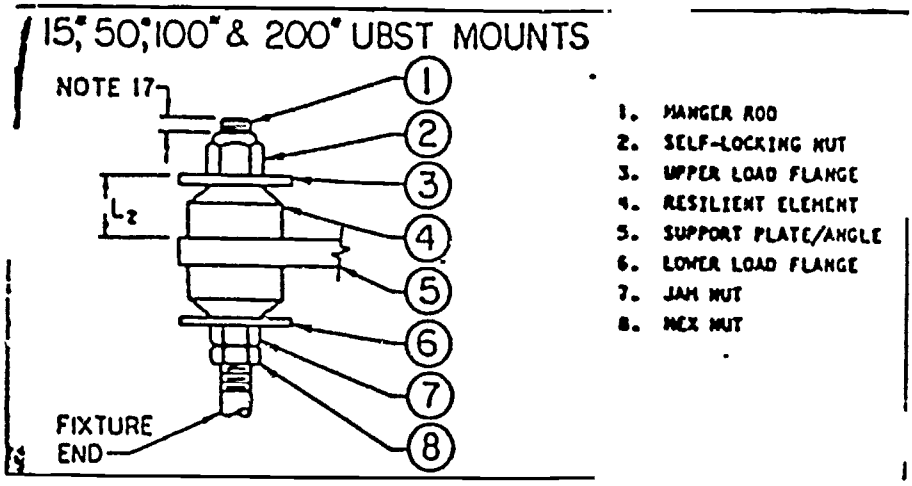
1. Rotate jam nut until it contacts lower load flange.
2. Rotate self-locking nut until it contacts upper load flange.
3. Rotate hex-nut to lock jam-nut in place.

HANDOUT: RESILIENT MOUNT LOADING PROCEDURES

1. Use of Installation and Adjustment/Inspection Gages



HANDOUT: RESILIENT MOUNT LOADING PROCEDURES
15#, 50#, 100#, and 200# UBST Mounts

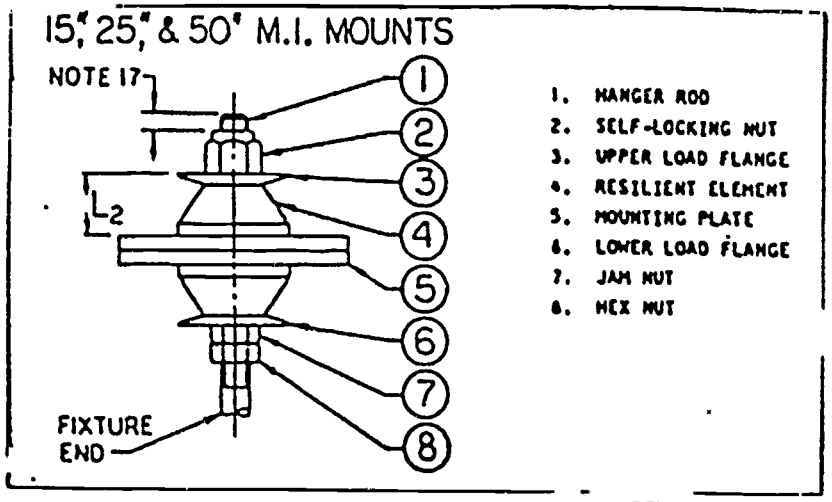


MOUNT SIZE	MINIMUM L_2 DIM. (80% OF RATED LOAD.
15#	.46"
50#	.87"
100#	.83"
200#	.89"

1. For initial installation follow steps 1-5 under general installation instructions.
2. After installation hangers and temporary supports are removed mounts may be adjusted. Each mount may adjusted in either direction, (tension or compression) but in no case should the L_2 dimensions be reduced to less than that specified above.
3. The gage for the mount being adjusted may be used to insure the 80% value is not being exceeded.

HANDOUT: RESILIENT MOUNT LOADING PROCEDURES

15#, 25#, and 50# Mare Island Mounts



MOUNT SIZE	MINIMUM L_2 DIM. (80% OF RATED LOAD)
15#	.49"
25#	.86"
50#	.84"

1. For initial installation follow steps 1-5 under general installation instructions.
2. After installation hangers and temporary supports are removed mounts may be adjusted. Each mount may be adjusted in either direction (tesion or compression) but in no case should the L_2 dimension be reduced to less than that specified above.
3. The gage for the mount being adjusted may be used to insure that the 80% value is not exceeded.

HANDOUT: RESILIENT MOUNT LOADING PROCEDURES

6E100EES and 6E150EES Mounts

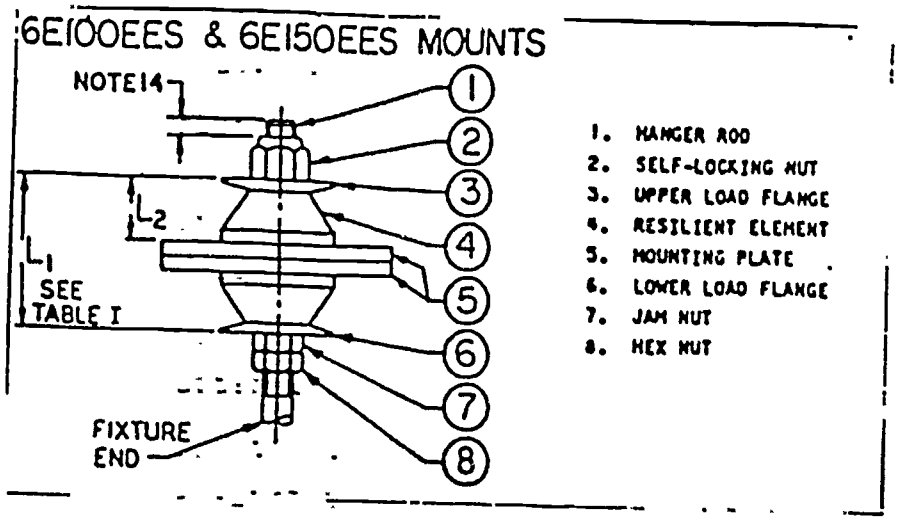


TABLE I	MOUNT	L_1 DIM.
	6E100EES	4.063
	6E150EES	4.140

TABLE II

MOUNT	INSTALLATION L_2 DIM. FOR USE ONLY WHEN A DASH IS SPECIFIED FOR LOAD		MINIMUM L_2 DIM. (ADJUSTMENT)	
	GAGE	FOR DIAL INDICATOR	GAGE	FOR DIAL INDICATOR
6E100EES	1.490	.104	1.370	.224
6E150EES	1.510	.053	1.390	.173

1. For initial installation follow steps 1-5 under general installation instructions.

2. When Tension is specified on the installation drawing:
   a. Rotate the self-locking nut until the upper load flange is moved with respect to the mounting plate, the amount specified in table II under heading "For Dial-Indicator " use, or until the gage for the mount indicates 50% of the rated load, whichever is applicable.
   b. Tighten jam-nut against lower load flange and lock in place with hex nut.

6E100EES and 6E150EES Mounts (cont.)

5. When Compression is specified on the installation drawing:

   a. Rotate the jam-nut until the lower load flange is moved with respect to the mounting plate, the amount specified on the installation drawing under "Installation" deflection.

   b. Tighten the self-locking nut against the upper load flange.

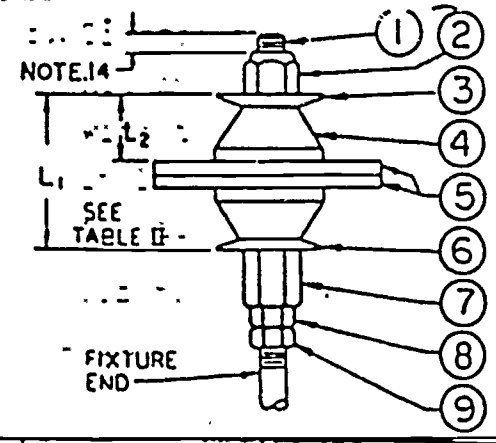
   c. Tighten the hex nut to lock the jam-nut against the lower load flange.

6. After installation hangers and temporary supports are removed, mounts may be adjusted. Each mount may be adjusted within a range from 0# to the maximum load and deflection as specified under "maximum" on the installation drawing for that mount.

HANDOUT: RESILIENT MOUNT LOADING PROCEDURES
6E100BBEES & 6E150BBEES & 7E450BBEES &
6E900BBEES and 6E2000BBEES Mounts

6E100BBEES, 6E150BBEES & 7E450BBEES MOUNTS

6E900BBEES & 6E2000BBEES MOUNTS



1. HANGER ROD
2. SELF-LOCKING NUT
3. UPPER LOAD FLANGE
4. RESILIENT ELEMENT
5. MOUNTING PLATE
6. LOWER LOAD FLANGE
7. PRELOAD LOCKING NUT
8. JAM NUT, TAB WASHER OR LOCKWASHER
9. HEX NUT

TABLE I

MOUNT	INSTALLATION L_2 DIM. FOR USE ONLY WHEN A DASH IS SPECIFIED FOR LOAD		MINIMUM L_2 DIM. (ADJUSTMENT)	
	GAGE	FOR DIAL INDICATOR	GAGE	FOR DIAL INDICATOR
6E100BBEES	1.490	.104	1.370	.224
6E150BBEES	1.510	.053	1.390	.173
7E450BBEES	1.253	.372	1.143	.482
6E900BB	1.930	.320	1.730	.520
6E2000BB	1.930	.383	1.730	.583

TABLE II

MOUNT	L_1 DIM
6E100BBEES	4.063
6E150BBEES	4.140
7E450BBEES	4.125
6E900BBEES	5.500
6E2000BBEES	5.875

1. For initial installation follow steps 1-5 under general installation instructions.

2. When Tension is specified on the installation drawing:

   a. Rotate the self-locking nut until the upper load flange is moved with respect to the mounting plate, the amount specified in table I

cont.

a. cont. under heading "For Dial-Indicator" use, or until the gage for the mount indicates 50% of the rated load, whichever is applicable.

b. Tighten the jam-nut against the pre-load locking nut and lock in place with the hex nut. For assy's with tabwashers, the hex nut should be tightened in lieu of the jam-nut and locked in place with the tabwasher.

3. When compression is specified on the installation drawing:

a. Rotate the jam-nut (hex nut for assemblies with tabwashers or lockwashers) until the lower load flange is moved with respect to the mounting plate, the amount specified in table I under heading "For Dial-Indicator" use, or until the gage for the mount indicates 50% of the rated load, whichever is applicable.

b. Tighten the self-locking nut against the upper load flange.

c. Tighten the hex nut to lock the jam-nut in place against the pre-load locking nut. For assemblies with tabwashers, the hex nut should be tightened in lieu of the jam-nut and should be locked in place with the tabwasher.

The following procedures are to be used when loads other than 0# are specified in the load columns on the installation drawing: cont'd.

4. When tension is specified on the installation drawing:

   a. Rotate the self-locking nut until the upper load flange is moved with respect to the mounting plate the amount specified on the installation drawing under "Installation" deflection.

   b. Tighten the jam-nut against the pre-load locking nut and lock in place with the hex nut. For assy's with tabwashers, the hex nut should be tightened in lieu of the jam-nut and should be locked in place with the tabwasher.

5. When compression is specified on the installation drawing:

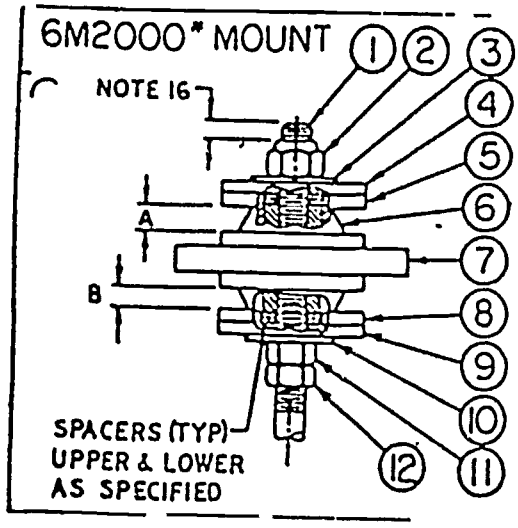
   a. Rotate the jam-nut (hex nut for assemblies with tabwasher or lockwasher) until the lower load flange is moved with respect to the mounting plate, the amount specified on the installation drawing under "Installation" deflection.

   b. Tighten the self-locking nut against the upper load flange.

   c. Tighten the hex nut to lock the jam-nut against the pre-load locknut. For assemblies with tab-washers, the hex nut should be tightened in lieu of the jam-nut and should be locked in place with the tabwasher.

   d. After installation hangers and temporary supports are removed, mounts may be adjusted. Each mount may be adjusted within a range from 0# to the maximum load and deflection as specified under "maximum" on the installation drawing for the specified hanger.

HANDOUT: RESILIENT MOUNT LOADING PROCEDURES
6M2000# Mare Island Mount



1. HANGER ROD
2. SELF-LOCKING NUT
3. WASHER (OPTIONAL)
4. UPPER SNUBBER PLATE
5. UPPER SNUBBER RING
6. RESILIENT ELEMENT
7. MOUNTING PLATE
8. LOWER SNUBBER RING
9. LOWER SNUBBER PLATE
10. WASHER (OPTIONAL)
11. JAM-NUT
12. HEX NUT

1. For initial installation follow steps 1-5 under general installation instructions.
2. Install hex nut, jam-nut, lower snubber plate, and required number of spacers, per applicable drawing then insert rod through mount.
3. Place required number of upper spacers, if any, on upper rod end, then the upper snubber assembly, washer, and self-locking nut.
4. Rotate the self-locking nut until it contacts the upper washer.
5. Tighten the jam-nut until the washer is tight against the lower snubber plate, and lock in place with the hex nut.
6. After installation hangers and temporary supports are removed, mounts may be adjusted. Each mount may be adjusted in either direction (Tension or Compression) but in no case should the "A" or "B" dimensions be reduced to less than $\frac{1}{4}$" (one-quarter inch)

6M2000# Mare Island Mount

The following instructions are for use when loads of other than 0# are specified in the load column on the hanger installation drawings:

7. When tension is specified on the installation drawing:
   a. Rotate the self-locking nut until the upper snubber plate is moved, with respect to the mounting plate, the amount specified on the installation drawing.
   b. Tighten the jam-nut against the lower snubber ring and lock in place with the hex nut.
8. When compression is specified on the installation drawing:
   a. Rotate the jam-nut until the lower snubber plate is moved with respect to the mounting plate, the amount specified on the installation drawing.
9. To complete, follow instructions numbered 4-6 in this procedure.

MASTER LESSON PLAN

I. COURSE TITLE PH 1 LESSON NUMBER _____

NAME OF INSTRUCTOR _____ DAY/PERIOD TAUGHT _____

II. OBJECTIVES OF LESSON

To instruct the apprentice in the various types of fasteners used in pipehanger construction and make them aware of their uses.

III. PRESENTATION

A. Bolting - The following is a list of the various types of bolts used in pipehanger construction.

1. Hex Head Bolt - common bolt used, is made up by threading at one end and a hex-head at the other end. Identified by manufacturer's marks on head of bolt. This type of bolt is available in a wide variety of materials, depending upon their application.

   Steel - Used above the bilge line and on hot systems.

   NiCu - Used in the bilge area, external tanks, internal tanks, and battery wells.

   CRES - Corrosion Resistant Steel or Stainless Steel is used mainly in the sail and other free-flood areas.

2. Self-Locking Bolt - Essentially the same materials used as hex-head bolts. The differences between hex-head bolts and self-locking bolts are few but distinct. Self-locking bolts are identified by a series of six (6) prick-punch marks on the head of the bolt and a plastic or nylon insert installed usually two (2) or three(3) threads from the stud end of the bolt. Self-locking bolts are used mainly for lug assemblies and steel block hangers.

3. Hex Nuts - A six (6) sided nut used on mount rods as jam nuts or used for temporary applications.

4. Self-Locking Nuts - A nut with a plastic insert manufactured into it. The nuts come with three (3) different color inserts:

   Green and Red - Polymide for non high-heat systems or normal applications.

   Brown - Vespel for use on hot systems.

COURSE TITLE PH 1 LESSON NUMBER

5. Castellated Nuts - for use with lockwire or cotter pins.

6. Clinch Nuts - An all metal nut used on hot systems, the base of the nut is the normal size while the clinch portion of the nut is tapered to insure a tight fit.

7. Materials - The most common materials that are used are but not limited to:

   Black Steel - Used mainly for Jam or Hex Nuts NiCu. Below the bilge line in tanks and battery wells.

   CRES - Used mainly in the sail and other free-flood areas is now being used for clinch nuts on high-heat systems.

IV. TESTS

V. MATERIALS

VI. REFERENCES

MASTER LESSON PLAN

I. COURSE TITLE - PH - 1 LESSON NUMBER _____

NAME OF INSTRUCTOR _____ DAY/PERIOD TAUGHT _____

II. OBJECTIVES OF LESSON

This lesson is designed to instruct the apprentice in the areas of Piping Insection-Pipehanger Attributes.

III. PRESENTATION

A. Hanger Type

1. Hanger used is type specified on detail drawing.

B. Location

1. Hanger must be on location as specified on arrangement drawing. If no tolerance is specified a dimension of ±3 must be used.

C. Configuration

1. Material type and configuration of hanger is correct and resilient mount is the type and size as specified by the detail drawing and the orientation of single EES mounts are correct.

D. Fasteners

1. Fastener materials meet drawing requirements and are properly identified.

E. Alignment

1. If a resilient mount hanger is visually misalinged, measure angular misalignment. Any misalignment greater than 5^{o} is unsatisfactory.

F. Welds

1. Welds must meet the requirements of SSP 3.10, Visual Inspection of Structural Welds, or SSP 13.10, Test, Inspection and Repair Stud Welded Attachments. Welds that do not require subsequent MT inspection are not required to be free of paint.

COURSE TITLE - PH - 1 LESSON NUMBER

G. Pipe Not Installed In Hanger

1. Inspection can be adequately performed for hangers without resilient mounts, provided all hardware is present except for the rubber grommet.

2. Inspection can only be partially performed for resilient mount hangers. An unsat will be written stating that inspection is incomplete because pipe is not installed.

H. Overcompression Between Pipe and Flat Bar

1. When the rubber between the pipe and the steel flat bar or channel (rubber block hanger) is overcompressed causing the distance between them to be less than 1/4", an unsat condition exists.

I. Gap Between Nut and Channel

1. Where a gap shows between the nut and channel bar (rubber block hanger), under a shock condition a high impact load could create a noise problem; therefore, any gap is an unsat condition.

J. Rubber Insert (Grommet) Allowances

1. After the surfaces between the hanger rubber and the pipe have been coated with "Molykote T 42", a certain amount of force could cause a hanger to twist on the pipe or the rubber to extrude. After tightening, clamps may be brought together as required, and 3/16" is the maximum gap allowed for all standard hangers except where noted on system drawings.

The following is a list of hanger attributes to be done during a Phase 2 Inspection.

K. Temporary Hangers

1. All temporary hangers and/or jacking devices must be removed from the piping system prior to a phase two inspection.

L. Overcompression or Extension of Rubber Elements

1. If a questionable condition exists, measure the compressed height "C" dimension of the resilient element.

See Table I of QAI 8006 Attachment 4

M. Fasteners

1. All fasteners must be secure with no gaps.

COURSE TITLE - _____ LESSON NUMBER_____

N. Resilient Mounts

1. Inspect resilient elements to insure they have not been painted and that the rubber elements are free of, cracks, burns, gouges and abrasions.

2. Minor paint spatter is permitted as long as paint does not bridge the resilient element causing metal-to-metal contact.

O. Gap Between Pipe and Rubber Block

1. After the hanger and pipe have set for a period of time, a gap could occur between the pipe and the rubber block. A gap of less than 1/4" is not considered to be an unsat condition.

IV. TEST

V. MATERIALS

QAI 8006 Attachment 4

VI. REFERENCES

SSP 23.15
QAI 8006

MASTER LESSON PLAN

I. COURSE TITLE - PH - 1 LESSON NUMBER_____

NAME OF INSTRUCTOR_____ DAY/PERIOD TAUGHT_____

II. OBJECTIVES OF LESSON

To teach the apprentice the proper procedures and materials needed in order to present a hanger to inspection.

III. PRESENTATION

A. Job Preparation

1. Obtain completed SWSS card on hanger to be inspected.
2. From SWSS card request hanger detail, arrangement drawing and all applicable standard plans from plan file.
3. Ascertain if any E.N.'s were used to aid in installation, if so, request E.N. or C.M. applicable through supervisor or planner.

B. Job Verification

1. Check hanger location using arrangement drawing and plan tolerances.
2. If hanger was installed using E.N. verify location to E.N.
3. Inspect hanger as per QAI 8006.
4. Correct any unsat. conditions.

C. Ready for Inspection

1. Upon being assigned an Inspector present him/her with completed SWSS card and present hanger with all associated plans required to inspect job.

IV. TESTS

V. MATERIALS

VI. REFERENCES

QAI 8006
SSP 23.15