DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

COMMANDANT (MMT-2)
U.S. COAST GUARD
WASHINGTON D.C. 20591

NVIC NO. 2-71
5 FEB 1971

NAVIGATION AND VESSEL INSPECTION CIRCULAR NO. 2-71

Subj: Pipe Stress Analysis Calculations; Procedure for Submission of

Ref: (a) 46 CPR 46.35-1(a)
(b) 46 CFR 56.07-10(c)
(c) 46 CFR 56.01-10

1. Purpose. To outline the material required to be included with the pipe stress analysis calculations which are submitted to the Commandant, United States Coast Guard, for review using digital computer facilities.

2. Cancellation. Navigation and Vessel Inspection Circular No. 3-65, dated 29 April 1965, is hereby canceled.

3. Background.

a. The majority of the pipe systems reviewed by the Coast Guard are reviewed solely for material and. internal pressure. These Systems do not require review by the Commandant and are normally reviewed by the nearest Marine Inspection Office or a field technical office as described in 46 CER 50.20-5(b) and (d).

b. However, the thermal stress analysis required by reference (a) and the dynamic analysis mentioned in reference (b) require the use of computer facilities. At the present time these facilities are not available to the local Marine Inspection Offices and the field technical offices. Therefore, this review is performed by the Commandant.

c. Pipe stress calculations submitted to the Commandant often do not contain sufficient information for proper evaluation and approval. The information required for the evaluation is also required for the design of a piping system and does not depend upon the method of analysis used. It is, therefore, readily available and a complete initial submission will greatly reduce the time required for Coast Guard approval.

4. Action. Submissions of stress calculations for piping systems requiring review by the Commandant (MMT) should contain the following in triplicate:

a. A dimensioned isometric schematic drawing of the complete piping system. The points for which the stresses are calculated should be numbered in sequence.

b. A description of the method of analysis used.

(1) If hand calculations are used, representative calculations should be submitted along with a tabular listing of the data described below.

(2) If a digital computer is used, a copy of the input data and the complete output should be submitted along with a brief description of the program being used. A description of the input and output formats and any special codings used in the program should also be submitted for proper interpretation of the data. If the input data does not contain all of the data listed below, a supplemental list of the missing data should be included.

c. For thermal stress analysis calculations required by reference (a), the following data is required:

(1) For each type and size of pipe used in the system:

(i) Pipe outside diameter in inches

(ii) Pipe wall thickness in inches

(iii) Expansion coefficient or thermal strain in mils (0.001 inch) of expansion per inch of pipe length. This is the total thermal strain from datum (70^0 F) to the design temperature.

(iv) Modulus of elasticity in tension at datum (70^0 F) in pounds per square inch

(v) Poisson's ratio

(2) For each anchor:

(i) Coordinates of the anchor point

(ii) Extraneous anchor movements in 'inches

(3) For each bend:

(i) Coordinates of the intersection point of the incoming and outgoing tangents

(ii) Bend radius

(4) For each branch intersection point:

(i) Coordinates of the intersection point

(5) For each valve, flange, or reducer:

(i) Coordinates of each end of the component

(ii) Length of the component

(iii) Expansion coefficient or thermal strain in mils (0.001 inch) of expansion per inch of component length. This is the total thermal strain from datum (70^0 F) to the design temperature.

(iv) Modulus of elasticity in tension at datum (70^0 F) in pounds per square inch

(v) Poisson's ratio

(6) Coordinates of any additional points for which the stresses are calculated.

d. For thermal stress analysis calculations seeking the increase in the allowable stress range permitted by section 102.3.2(d) of the American National Standards Institute (ANSI) Code B-31.l (Power Piping), the following data is required:

(1) The data required in 4.c. above

(2) For each type and size of pipe used in the system:

(i) Internal pressure in pounds per square inch

(ii) Weight of the pipe and insulation in pounds per inch of pipe length

(3) For each hanger or restraint:

(i) Coordinates of the point of attachment to the pipe or component

(ii) Translation or rotational flexibility in inches per pound or radians per inch-pound as appropriate for the type of hanger or restraint

(iii) Coordinates of the point of attachment to the ship

(iv) Initial or dead weight load in pounds or inch-pounds as appropriate for the type of hanger or restraint

(v) Extraneous hanger or restraint movements in inches or radians as appropriate for the type of hanger or restraint

(4) For each valve, flange or reducer:

(i) Coordinates of the centered of the component

(ii) Weight of the component and insulation in pounds

e. For dynamic stress analysis calculations mentioned in reference (b), the following data is required:

(1) The data required in 4.c. and 4.d. above

(2) A. description of the method of determining the accelerations on the system including all assumptions made in the analysis.

(i) If hand calculations are used, representative calculations should be submitted.

(ii) If a digital computer is used, a copy of the input data and the complete output should be submitted along with a brief description of the program being used. A description of the input and output formats and any special codings used in the program should also be submitted for interpretation of the data.

(3) The resultant accelerations and their direction cosines.

f. If review of the materials and internal pressure is requested to be performed by the Commandant (MMT), it will require submission of all of the data listed in reference (c) in addition to the above listed data.

W. F. REA, III
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DIST (SDL NO.92)

A: None
B: n(45); c(l0); q(6); e g (3); b p (1)
C: m(4); o(2)
D: i(2); k(l)
B: o(2)
F: None
List CG-12