MIL-T-24270B(SH)
2 September 1983
SUPERSEDING
MIL-W-24270A(SHIPS)
13 May 1971
(See 6.8)

MILITARY SPECIFICATION

THERMOWELLS FOR THERMOMETERS AND ELECTRICAL TEMPERATURE SENSORS GENERAL SPECIFICATION FOR

This specification is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers wells (thermowells) for use with thermometers and electrical temperature sensors. Older military specifications may still refer to electrical temperature sensors as electrical temperature elements (thermocouple, temperature elements and resistance temperature elements).

1.2 Classification. Thermowells shall be of the following physical designs to receive the sensors of mechanical thermometers or electrical temperature sensors (see 6.2.1). A military part number system shall identify each variation of thermowell design in accordance with the following:

Example: Military part number M24270/1-E2CUNI

M	24270	1	- E	2	CUNI
Prefix to indicate a military specification	Specification number	Design (see 1.2.1)	Sensor type (see 1.2.2)	Insertion (see 1.2.3)	Material (see 1.2.4)

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 6685

1.2.1 Design. Thermowell designs shall be in accordance with the applicable specification sheet number as follows:

Design symbol	Design (specification sheet no.)
1	MIL-T-24270/1
2	MIL-T-24270/2
3	MIL-T-24270/3
4	MIL-T-24270/4
7	MIL-T-24270/7
12	MIL-T-24270/12
13	MIL-T-24270/13
18	MIL-T-24270/18
21	MIL-T-24270/21
22	MIL-T-24270/22
25	MIL-T-24270/25

1.2.2 Sensor type. Thermowells shall have an internal bore dimension suitable for mechanical thermometers or electrical temperature sensors as follows:

Symbol	Sensor type	Sensor details
M	Mechanical	MIL-I-17244 and MIL-T-19646
E	Electrical	MIL-T-24388

1.2.2.1 Definition of sensor type. Mechanical thermometers shall be either bimetallic (MIL-I-17244) or filled system (MIL-T-19646). Electrical temperature sensors shall be either thermocouples or resistance temperature sensors (MIL-T-24388).

1.2.3 Insertion length. Thermowell insertion length shall be one of the following:

Symbol	Insertion length (inches)
2	2
4	4
3.5	3-1/2 (electrical sensor only)
5.5	5-1/2 (mechanical sensor only)
L	As required to fit the application

1.2.4 Materials. Thermowells shall be made of materials as follows:

Symbol	Material
CNR	Copper-Nickel (90-10)
CUNI	Copper-Nickel (70-30)
CRES	Corrosion Resisting Steel
NICU	Nickel-Copper
ALBR	Aluminum Bronze
CSA	Steel

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation, form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

QQ-C-465	- Copper-Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 614, 630, 632M, and 642); Rod, Flat Products with Finished Edges (Flat Wire, Strip, and Bar), Shapes and Forgings.
QQ-N-281	- Nickel-Copper-Alloy (Monel and R-Monel) Rods, Plates, Bars, Sheets, Strips, Wire, Forgings, and Structural and Special Shaped Sections.
QQ-S-763	- Steel Bars, Wire, Shapes and Forgings.

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MIL-C-15726	- Copper-Nickel Alloy Rods, and Flat Products (Flat Wire, Strip, Sheet, Bar and Plate) and Forgings.
MIL-I-17244	- Indicators, Temperature, Direct Reading, Bimetallic (3 and 5 Inch Dial).
MIL-T-19646	- Thermometers, Remote Reading, Self-Indicating Dial, Gas Actuated.
MIL-T-24388	- Thermocouples and Resistance Temperature Element Assemblies, General Specification For (Naval Shipboard).

STANDARDS

FEDERAL

FED-STD-H28	- Screw Thread Standards for Federal Service.
FED-STD-H28/2	- Unified Thread Form and Thread Series for Bolts, Screws, Nuts, Tapped Holes and General Applications.

MILITARY

MIL-STD-129	- Marking for Shipment and Storage.
MIL-STD-438	- Schedule of Piping, Valves Fittings and Associated Piping Components for Naval Submarine Service.
MIL-STD-777	- Schedule of Piping, Valves Fittings and Associated Piping Components for Naval Surface Ships.
MS16142	- Boss, Gasket Seal Straight Thread Tube Fitting, Standard Dimensions.

(See supplement 1 for applicable specification sheets.)

2.1.2 Other Government drawings and publications. The following other Government drawings and publications form a part of this specification to the extent specified herein.

NAVAL SEA SYSTEMS COMMAND (NAVSEA)
NAVSHIP 810-1385917 - Temperature Indicator and Thermowell Selection.

PUBLICATIONS
NAVSEA 0900-LP-00-038-8010 - Ship Metallic Material Compression and Use Guides.
NAVSEA 0948-LP-045-7010 - Material Identification and Control (MIC) for Piping Systems Volume 1.

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS and the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
B46.1 - Surface Texture. (DoD adopted)
Y14.5 - Dimensioning and Tolerancing. (DoD adopted)

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018.)

ASTM
A 105 - Hand Drawn Copper Alloy Wires for Electric Conductors.
B 150 - Rod, Bar and Shapes Aluminum Bronze. (DoD adopted)

(Application for copies should be addressed to the ASTM, 1916 Race Street, Philadelphia, PA 19103.)

NATIONAL MOTOR FREIGHT TRAFFIC ASSOCIATION, INC., AGENT
National Motor Freight Classification

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., ATA TRAFFIC Dept., 1616 "P" Street, NW, Washington, DC 20036.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Materials. Thermowells shall be of the following wrought or forged materials. Metal material specified in accordance with NAVSEA 0900-LP-038-8010 may be substituted if physical and chemical characteristics are similar.

Material	Symbol	Specification
Copper-nickel (70-30)1/	CUNI	MIL-C-15726
Corrosion resisting steel2/	CRES	QQ-S-763 classes 316, 321, 347
Nickel-copper3/	NICI	QQ-N-281
Aluminum bronze3/	ALBR	QQ-C-465
Aluminum bronze3/	ALBR	ASTM B 150 alloy C63200
Copper-nickel (90-10)3/	CNR	MIL-C-15726
Steel3/	CSA	ASTM A 105, GR2

1/ Cu-Ni material shall be used in systems of MIL-STD-777 or MIL-STD-438 where nonferrous materials are required.
2/ CRES material shall be used in systems of MIL-STD-777 or MIL-STD-438 where ferrous materials are required.
3/ Provided where necessary in accordance with MIL-STD-777 or MIL-STD-438.

3.2.1 Level of essentiality. When specified (see 6.2.1), the equipment shall be designated level 1 thermowells. Material identification and control shall be in accordance with NAVSEA 0948-LP-045-7010 as applicable. When level 1 is specified for thermowells to be used in oxygen systems, a certificate shall include objective data on cleaning.

3.2.2 Recovered materials. Unless otherwise specified herein, all equipment, material and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3 Construction.

3.3.1 Design. Thermowells shall be in accordance with the applicable specification sheet (see 6.1.1). Dimensions and tolerances of thermowells shall be in accordance with the applicable specification sheet.

3.3.2 Sensor type.

3.3.2.1 Mechanical. Thermowells symbol "M" shall receive thermometer sensing elements in accordance with MIL-I-17244 or MIL-T-19646.

3.3.2.2 Electrical. Thermowells symbol "E" shall fit electrical sensors in accordance with MIL-T-24388.

3.3.3 Rated pressure and temperature. Thermowells rated pressure and temperature shall be as specified in the individual specification sheet (see 6.1.1, footnote 1).

3.3.4 Insertion length. Thermowells insertion length shall be in accordance with the individual specification sheet (see 3.1).

3.4 Installation. Installation, methods of attachment and insertion lengths shall be in accordance with Drawing 810-1385917.

3.5 Threads. Threads shall be in accordance with FED-STD-H28 and FED-STD-H28/2. Taper pipe threads shall not be used.

3.6 Marking. Unless otherwise specified as level I materials (see 6.3), each thermowell shall be etched or stamped with the following information:

(a) Manufacturer's trademark.
(b) Material symbol (see 3.2).

3.7 Finish. Surface texture shall be interpreted in accordance with ANSI B46.1. Dimensioning and tolerancing shall be interpreted in accordance with ANSI Y14.5.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Inspection system. The contractor shall provide and maintain an inspection system in accordance with the data ordering documents included in the contract (see 6.2.2).

4.1.2 Calibration system. The contractor shall provide and maintain a calibration system for measuring instruments and test standards in accordance with the data ordering document included in the contract (see 6.2.2).

4.2 Dimensional examination. Unless otherwise specified, the wells shall be dimensionally examined in accordance with the applicable specification sheet. Proper construction of the thermowell in accordance with the applicable specification sheet will ensure that the thermowell will meet the requirements of 3.3.2.1, 3.3.2.2 and 3.3.3.

4.2.1 Coaxiality controls. Coaxial controls shall be in accordance with ANSI Y14.5 as follows:

Out of round - .005 inch TIR (total indicator reading)
Concentricity - .005 inch TIR

4.3 Quality conformance inspection.

4.3.1 Lot. For purposes of inspection, a lot shall consist of all wells, grouped according to material and insertion length offered for delivery at one time under the same contract or order.

4.3.2 Sampling for examination, materials and interchangeability. A random sample of wells shall be selected from each lot (see 4.3.1) in accordance with table I for the examination specified in 4.4. (The acceptable quality level (AQL) shall be in accordance with table I and MIL-STD-105.)

TABLE I. Sampling for examination, materials and interchangeability.

Number of wells in a lot	Number of wells in sample	Defectives	
		Acceptance number	Rejection number
Up to 10	All	-	-
11 to 25	10	0	1
26 to 40	15	0	1
41 to 65	25	1	2
66 to 110	35	1	2
111 to 180	50	2	3
181 to 300	75	3	4
301 to 500	110	4	5
501 to 800	150	5	6
801 to 1300	225	8	9
1301 to 3200	300	10	11
3201 to 8000	450	14	15
8001 to 15000	750	20	21

4.4 Examination of parts. Each sample selected in accordance with 4.3.2 (see table I) shall be examined to determine conformance to the requirements of this specification (see 4.2). Any unit containing one or more defects shall be rejected and if the number of defective units in any sample exceeds the acceptance number for that sample, the lot represented by the sample shall be rejected. Packaging and packing shall be inspected to insure that they meet the requirements of 5.1.1.1 and 5.1.1.2, respectively.

5. PACKAGING

(The preparation for delivery requirements specified herein apply only for direct Government acquisitions. For the extent of applicability of the preparation for delivery requirements of referenced documents listed in section 2, see 6.7.)

5.1 Domestic shipment and early equipment installation.

5.1.1 Wells.

5.1.1.1 Preservation and packaging. Preservation and packaging which may be the contractor's commercial practice shall be sufficient to afford adequate protection against corrosion, deterioration and physical damage during shipment from the supply source to the using activity and until early installation.

5.1.1.2 Packing. Packing shall be accomplished in a manner which will ensure acceptance by common carrier, at lowest rate, and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early installation. The shipping containers or method of packing shall conform to the Uniform Freight Classification Ratings, Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may conform to the contractor's commercial practice.

5.1.1.3 Marking. Shipment marking information shall be provided on interior packages and exterior shipping containers in accordance with MIL-STD-129. The information shall include nomenclature, national stock number and manufacturer's part number, contract or order number, contractor's name and destination.

6. NOTES

6.1 Intended use. The thermowells are intended for use with thermometers and electrical temperature sensors as described in 6.1.1 through 6.1.3.

6.1.1 Designs. Thermowell designs are intended for use as follows:

Specification sheet no.	Insertion length (inches)	Method of mounting	Application 1/
1	2	3/4 inch NPS socket	For mounting thermowells in tee fitting, 2 to 4 inches pipe size with branch connection 3/4 inch NPS socket for socket welding or brazing the thermowell.
2	2	3/4 inch NPS socket	For mounting in tee fitting, 2 to 4 inches piping size with 3/4 inch NPS socket size on branch connection, for socket welding or brazing the thermowell.

(See footnote on next page).

Specification sheet no.	Insertion length (inches)	Method of mounting	Application[1/]
3	4	3/4 inch NPS socket	For mounting in 3/4 inch NPS socket boss on piping above 4 inches size.
4	4	3/4 inch NPS socket	For mounting in 3/4 inch NPS socket boss on piping above 4 inches size.
7	"M" 5-1/2 "E" 3-1/2	1 inch NPS pilot boss or integrally reinforced insert butt welding pipe fitting type boss	Main steam piping 1500 lb/in^2, 1000°F (538°C) maximum, 5 inches pipe size and larger, steam velocity not to exceed 180 ft/sec for 5-1/2 inches (M) or 450 ft/sec for 3-1/2 inches (E) insertion length. Well material CRES.
12	2	1-1/8 o.d. socket	Air conditioning and refrigerant systems.
13	4	1-1/8 o.d. socket	Air conditioning and refrigerant systems.
18	L ("M" only) double support insertion length depends on pipe size	Pilot boss or integrally reinforced insert butt welding pipe fitting type boss	Thermowell for mechanical thermometers where steam velocities exceed 180 ft/sec.
21	2	Threaded boss, 1-5/16-12UN-2B size, O-ring seal in accordance with MS16142	For mounting thermowells in boss of material not suitable for welding or brazing.
22	4		
25	N/A	N/A	Extension neck adapter.

1/ Selection of a thermowell shall be based on the particular material requirements, maximum pressure, maximum temperature and maximum flow conditions of the system. This selection shall be performed in accordance with Drawing 810-1385917.

6.1.2 Sensor types. "M" design is for thermometers in accordance with MIL-I-17244 or MIL-I-19646. "E" design is for electrical sensors in accordance with MIL-T-24388. Thermometer and electrical temperature sensor selection for specific thermowells are in accordance with the following:

MIL-T-24270 specification sheet no.	Thermowell insertion length (inches)	MIL-I-17244 stem length (inches)	MIL-T-19646 Adjustable union	MIL-T-24388[1/] Probe compressed length
1,2,12,21	2	2 (sensitive portion 1-1/2 inches long maximum)	Sensing bulb 1-1/2 inches long maximum	2-11/16
3,4,13,22	4	4 (sensitive portion 3 inches long maximum)	Sensing bulb 3 inches long maximum	4-11/16
7	"M" 5-1/2 "E" 3-1/2	Not applicable Not applicable	Sensing bulb 3-1/2 inches long maximum	4-19/32
18	"M" only (to fit piping)	Not applicable	Sensing bulb 3 inches long maximum	Not applicable

1/ The probe compressed length is defined to be the difference between the dimensions L and A on table II and figure 1 of MIL-T-24388.

6.1.3 Material. See 3.2.

6.2 Ordering data.

6.2.1 Acquisition requirements. Acquisition documents should specify the following:

(a) Title, number and date of this specification.
(b) Design, sensor type, insertion length, material, and rated pressure (see 1.2).
(c) Level of essentiality required (see 3.2.1).
(d) Length "L" for MIL-T-24270/18 when applicable.

6.2.2 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL), the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL incorporated into the contract. When the provisions of DAR 7-104.9 (n)(2) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification is cited in the following paragraphs.

Paragraph no.	Data requirement title	Applicable DID no.	Option
4.1.1	Inspection system program plan	DI-R-4803	----
4.1.2	Calibration system description	DI-R-7064	10.1

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5000.19L., Vol. II, AMSDL. Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in section 3, 4, or 5 of the specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specific data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

6.3 Thermowell selection. Criteria for selection of thermowell materials and design; method of attachment to pressure vessel, pipe, tank, fitting or bulkhead; type of joint (silver-brazed or socket-welded and full-penetration-welded) between the thermowell and mounting are detailed on Drawing 810-1385917. Identification and control for material used in critical piping systems (level I) shall be in accordance with NAVSEA 0948-LP-045-7010.

6.4 Stress calculations. The method of determining maximum allowable stresses with regard to applicable system characteristics in order to select an acceptable material is shown on Drawing 810-1385917, Note 8.

6.5 Material selection. The material selection shall be compatible for either welding or silver brazing and the applicable rated pressure and temperature limits of the system in which the thermowell will be used (see MIL-STD-438 or MIL-STD-777). Material for designated use shall be selected according to the footnotes of 3.2 of this specification.

6.6 Insertion length selection. The combination of the insertion length of the thermowell and the stem length of the thermal element will be selected to ensure that the sensitive portion of the temperature sensing element is completely immersed in the medium whose temperature is being measured.

6.7 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.8 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue, due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 6685-N681)

INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge *(DO NOT STAPLE)*, and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

NOTE: This form may not be used to request copies of documents, nor to request waivers, deviations, or clarification of specification requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-T-24270B(SH)	GENERAL SPECIFICATION FOR THERMOWELLS FOR THERMOMETERS AND ELECTRICAL TEMPERATURE SENSORS

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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