MIL-STD-1252
30 JUN 1975

MILITARY STANDARD

INERTIA FRICTION WELDING
PROCESS, PROCEDURE AND PERFORMANCE QUALIFICATION

FSC-THJM

DEPARTMENT OF DEFENSE
WASHINGTON, D.C. 20301

Inertia Friction Welding Process for

MIL-STD-1252(WC)

1. This Military Standard is approved for use by all Departments and Agencies of the Department of Defense.

2. Recommended corrections, additions or deletions should be addressed to the Commander, Rock Island Arsenal, ATTN: SARRI-LE-S, Rock Island, Illinois, 61201.

CONTENTS

1. SCOPE

1.1 Scope. This standard contains design requirements and design considerations for the use of inertia friction welding, requirements for certification of welding equipment, qualification of welding procedures, and qualification of operators using these procedures and equipment.

1.2 Classification Type and Class.

Type 1. Weldments which have high stresses imposed on them or have severe fatigue requirements.

Class A. Designates a solid stock joint or a solid stock joint subject to heat treatment after welding. For such a weld joint, no unwelded area is permitted. An unwelded center area will be acceptable only if the unwelded area is removed by a subsequent fabrication process.

Class B. Designates a tubular configuration joint where no unwelded area is permitted.

Flash should be removed from Type I weldments. This type and its classes will be assigned to weldments in which failure could result in injury to personnel.

Type II. Weldments which have light to moderate service stresses imposed on them or have low fatigue requirements.

Class A. Designates a solid stock joint where center defects are acceptable. The acceptability of such defects shall be determined by the procuring activity, but in any case the unwelded area shall not represent more than 10% of the total weld cross sectional area.

Class B. Designates a joint involving a tubular configuration or a joint involving solid state components with nonessential metal removed from the center.

Flash removal is not mandatory for Type II weldments. This type and classes will be assigned to weldments in which failure will not result in injury to personnel.

2. Applicable Documents.

2.1 Government Documents. The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of the standards to the extent specified herein.

FEDERAL STANDARD

Fed. Test Method Std. No. 151-Metals; Test Methods.

(Activities outside the Federal Government may obtain copies of Federal Specifications and Standards as outlined under General Information in the Index of Federal Specifications and Standards and at prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

(Single copies of this specification and other product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, MO, Fort Worth, Denver, San Francisco, Los Angeles and Seattle, WA.)

(Federal Government Activities may obtain copies of Federal Specifications and Standards and the Index of Federal Specifications and Standards from established distribution points in their Agencies.)

MILITARY SPECIFICATIONS.

MIL-I-6866 - Inspection, Penetrant Method of.
MIL-I-6868 - Inspection Process, Magnetic Particle.
MIL-I-6870 - Inspection Program Requirements, Nondestructive Testing, For Aircraft and Missile Materials and Parts.
MIL-W-80244 - Welding Machines, Friction; Conventional and Inertia Types.
MIL-H-8950 - Inspection, Ultrasonic, Wrought Metal, Process for.

MILITARY STANDARDS.

MIL-STD-418 - Mechanical Tests for Welded Joints.
MIL-STD-453 - Inspection, Radiographic.

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring 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. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Welding Society (AWS) Standard.

AWS A2.0 - Welding Symbols
AWS A2.2 - Nondestructive Testing Symbols
AWS A4.0 - Standard Methods for Mechanical Testing of Welds
AWS B1.1 - Welding Inspection

(Application for copies should be addressed to the American Welding Society, 2501 N.W. 7th Street, Miami, FD 33125).

American Society for Nondestructive Testing.

SNT-TC-IA - Nondestructive Testing Handbook, Volume I and II.

(Application for copies should be addressed to the American Society for Nondestructive Testing Inc. 914 Chicago Ave. Evanston, Ill. 60202).

American Society for Testing and Materials (ASTM) Publication.

ASTM A370 - Mechanical Testing of Steel Products.
ASTM E3 - Preparation of Metallographic Specimens.
ASTM E10 - Test for Brinell Hardness of Metallic Materials.
ASTM E92 - Test for Vickers Hardness of Metallic Materials.
ASTM E94 - Recommended Practice for Radiographic Testing.
ASTM E99 - Reference Radiographs for Steel Welds.
ASTM E109 - Dry Powder Magnetic Particle Inspection.
ASTM E112 - Estimating the Average Grain Size of Metals.
ASTM E125 - Reference Photographs for Magnetic Particle Indications on Ferrous Castings.
ASTM E138 - Wet Magnetic Particle Inspection.
ASTM E164 - Ultrasonic Contact Inspection of Weldments.
ASTM E165 - Liquid Penetrant Inspection.
ASTM E309 - Recommended Practice for Eddy Current Testing of Steel Tubular Products with Magnetic Saturation.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.)

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

3. Definitions.

3.1 Center Defect. This is a centrally located, unbonded section of the faying surfaces. The lack of bonding may be caused by too low rotational velocity, too low energy, excessive thrust load, joint configuration, faying surface condition or slippage in chuck or fixture.

3.1.1 Flash. Flash or weld flash is the material extruded from the weld interface due to the forging action of the applied thrust load. Flash will be obtained on both the O.D and I.D of tubular parts in equal amounts during the welding process.

3.1.2 Weld upset or upset loss is the difference in length between the welded and unwelded components. Upset results from the displacement of the material at the weld interface and is dependent on weld energy, rotation velocity and thrust load.

3.1.3 Inertial Mass and Weld Energy.

a. Inertial Mass: $M_I = WK^2$ where W is weight in pounds of the flywheel assembly and K is the radius of gyration in feet.

Units: lb - ft^2

b. Weld Energy: $E_K = M_I \frac{(RPM)^2}{5873} = \frac{WK^2 (RPM)^2}{5873}$

Units: ft = lb

3.1.4 Faying Surface. That surface of a member which is in contact or proximate to another member to which it is to be joined.

3.1.5 Joint Efficiency. The ratio of the strength of a joint to the strength of the base metal (expressed in percent.)

3.1.6 Thrust Force. The force exerted at the faying surface to produce friction and upset.

4. General Requirement.

4.1 Inertia Friction Welding. Two metallic parts to be joined are securely chucked, one in a tailstock fixture and the other in the rotating spindle. The spindle rotation is brought to a predetermined R.P.M to produce the desired surface velocity and to generate the proper level of kinetic energy in the rotating inertial mass (spindle mass). The flywheel may or may not be attached, depending on the kinetic energy requirements of specific applications. At the desired RPM the spindle drive is disengaged allowing only the kinetic energy to drive the spindle. When the drive has disengaged, the controlled hydraulic ram pressure (thrust force) forces the parts together at the faying surfaces. The hydraulic ram may be mounted either at the headstock or tailstock depending on the design of the machine. Friction between the two surfaces converts the kinetic energy to heat which combines with the thrust force to create a forging action and welds the two parts together thereby stopping the spindle.

4.2 Materials. Material to be welded shall be in accordance with the material and heat treatment requirements specified on the applicable drawing(s). The materials specified shall meet the requirements of the latest issue of the material specifications and standards in effect on the date of invitation for bids.

4.2.1 Ferrous, nonferrous and dissimilar metals may be welded by inertia welding. For information purposes table I is a partial list of metals and metal combinations which may be welded.

TABLE I
METALS JOINED BY INERTIA WELDING
(PARTIAL LIST)

SIMILAR METALS

Carbon Steels	Aluminum Alloys	Cobalt Alloys
Sintered Steels	Copper	Titanium
Stainless Steels	Brasses, Bronzes*	Zincalloy
Tool Steels	Molybdenum	Inconel
Alloy Steels	Waspalloy	Nickel Alloys

*except bearing types

DISSIMILAR METALS

High-speed steel to various steels	Colbalt - base alloys to steel
Sintered steels to wrought steels	347 stainless to 17-4 PH
316 stainless steel to inconel	Copper to 1100 or 6061 aluminum
Stainless steel to medium and low - carbon steels	Copper to medium - carbon steel
1100 or 6061 aluminum to medium - carbon steel	Copper to various brasses
	Aluminum bronze to medium carbon steel
	Nickel - base alloys to steel

4.2.2 The following are not recommended for inertia welding:

a. Tin and leaded bronze bearing materials.
b. Steels containing over 15% lead, sulfur or selenium.
c. Metals subject to "hot shortness".
d. Carburized surfaces.

4.2.3 Cast iron cannot be inertia welded.

4.3 Heat Treatment. Post-weld heat treatment of the weld zone may be needed to develop the required joint efficiency specified.

4.4 Metallographic. When a section through the weld zone is examined metallographically the heat affected zone (HAZ) shall be uniform across the smallest part joined. The HAZ shall be free of discontinuities such as cracks, inclusions, porosity or brittle phases. Acceptance standards of the base metal specifications shall be used to determine the acceptability of weld defects resulting from inclusions and stringers in the base metal. There shall be indications of plastic flow of material at and adjacent to the faying surfaces.

4.5 Design considerations.

4.5.1 In inertia friction welding, one part is held stationary and the second part is rotated. Designs which are readily adaptable to "Chucking" are advantageous as tooling requirements are simplified.

4.5.2 Ideally the contact area should be circular, however some deviation can be accommodated. Hexagonal and octagonal shapes can be welded, but radial orientation of corners may be impractical. Prior development of necessary tooling shall be considered before final design for other than round joints, or components which must have a controlled rotation relationship.

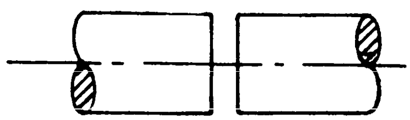
The rotating members should be symmetrical to the center axis of the joint interface. It is possible to rotate nonsymmetrical components by counterbalancing the chucking mechanism. But such designs should be finalized only after an economic evaluation.

4.5.3 As a general rule, the minimum cross-sectional area of the part and the surface area chucked should each be equal to the faying surface area. This is recommended to provide adequate gripping surface to avoid slippage, and to resist the torque developed during welding without deforming the part. In any circumstance, the material strength to cross section relationship must be such as will withstand a torque equivalent to a shearing stress of 12,000 - 15,000 PSI at the weld interface.

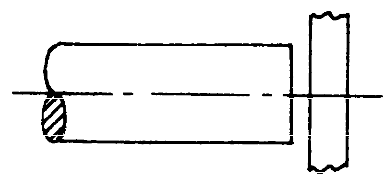
4.5.4 Friction weld joints are basically "butt" joints. The five most basic variations are illustrated in Figure I.

FIGURE I

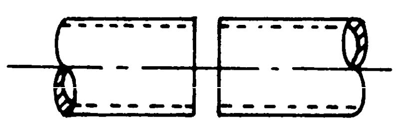
FIVE BASIC TYPES OF WELD JOINTS



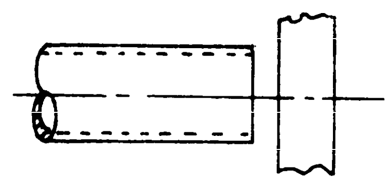
TYPE 1
SOLID ROUND TO MATCHED
SOLID ROUND



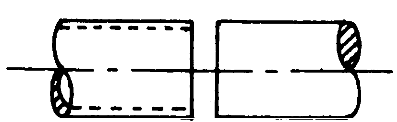
TYPE 2
SOLID ROUND TO
LARGER FLAT AREA



TYPE 3
TUBULAR TO MATCHED
TUBULAR COMPONENT



TYPE 4
TUBULAR TO
LARGER FLAT
AREA

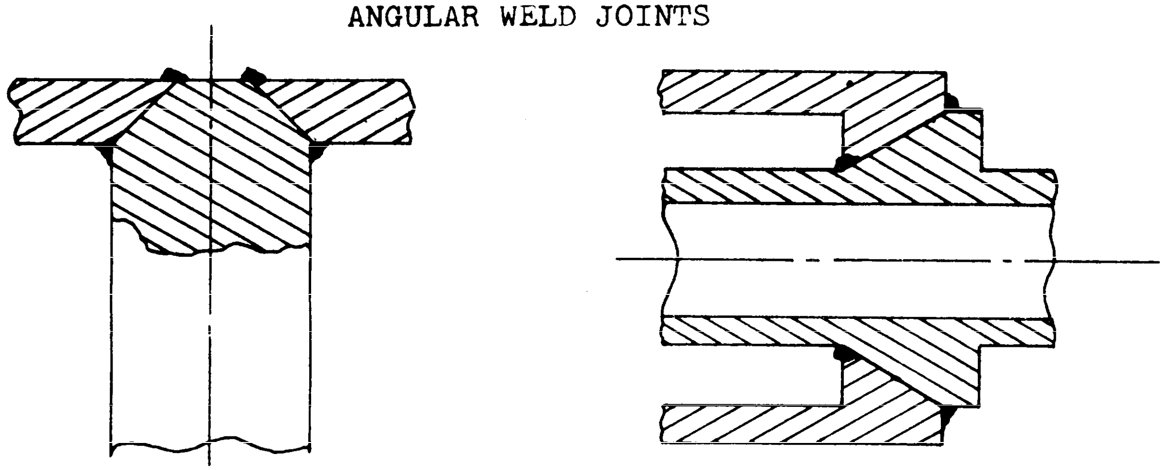


TYPE 5
TUBULAR COMPONENT
TO SOLID ROUND
COMPONENT

4.5.5 Angle joints are usually designed with faces 30° to 45° from the center line, although angles as low as 8° have been made. For the more easily forged materials, the greater angles are preferred to prevent pushing the one part through the hole. Figure II illustrates two types of welding angular joints.

FIGURE II

ANGULAR WELD JOINTS



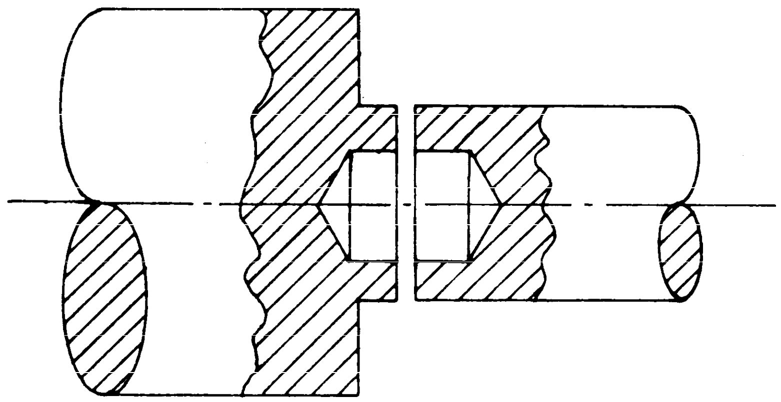
TYPE 1
PLATE - BAR

TYPE 2
TUBE - TUBE

4.5.6 If design strength requirements are such that the entire joint cross section need not be welded, consider removal of nonessential metal from the center. See Figure III for illustration of the principle of stock removal for reducing the area of the faying surfaces.

FIGURE III

CENTER RELIEF JOINT



4.5.7 When welding metals with widely differing forging temperature strengths or thermal conductivities or parts of widely differing masses, adjustment of the faying surface ratio of the parts may be necessary. By experiments the needed ratio can be established. See Figures IV A and IV B for examples of faying surfaces area matching.

FIGURE IV A

Design with fay surface area ratio not equal to 1. Parts of different materials.

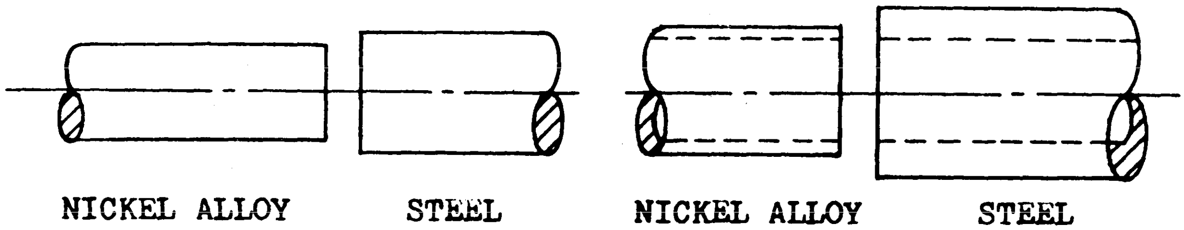
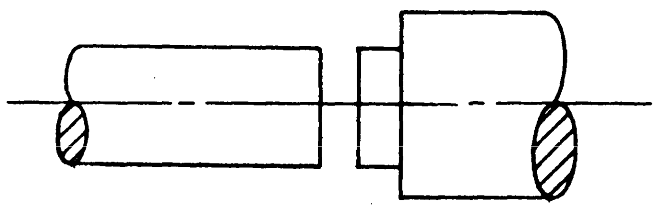


FIGURE IV B

Design with fay surface area ratio equal to 1. Parts of the same material.



4.6 <u>Classification.</u>

4.6.1 Inertia friction weld joints shall be classified in accordance with section 1.2.

4.6.2 Inertia friction welding requirements shall be specified on the drawings as given herein, and in Figure V.

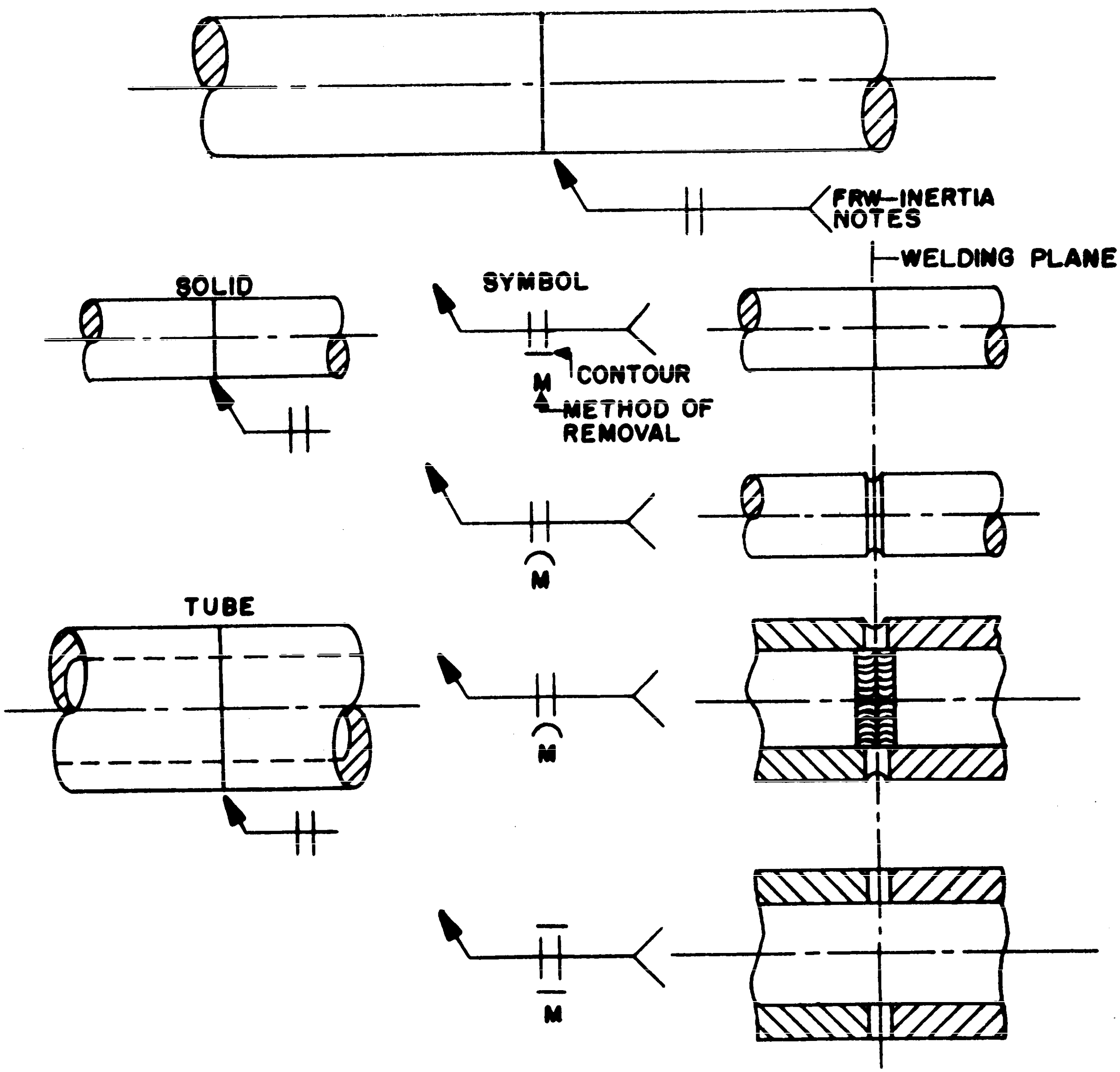
4.6.2.1 Weld symbols shall be in accordance with AWS A2.0. Welding Symbols.

4.6.2.2 Symbols for weld flash contour and/or method of removal shall be in accordance with AWS A2.0. The height of flash or depth of removal shall be indicated as a note in the tail of the weld symbol (arrow). See Figure V for weld symbol indication of flash or upset contour.

4.6.2.3 The type and class of welds required (see 1.2) shall be indicated as a note in the tail of the weld symbol (arrow). Example: MIL-STD-1252(WC) Type 1 class A.

FIGURE V

WELD SYMBOL USAGE

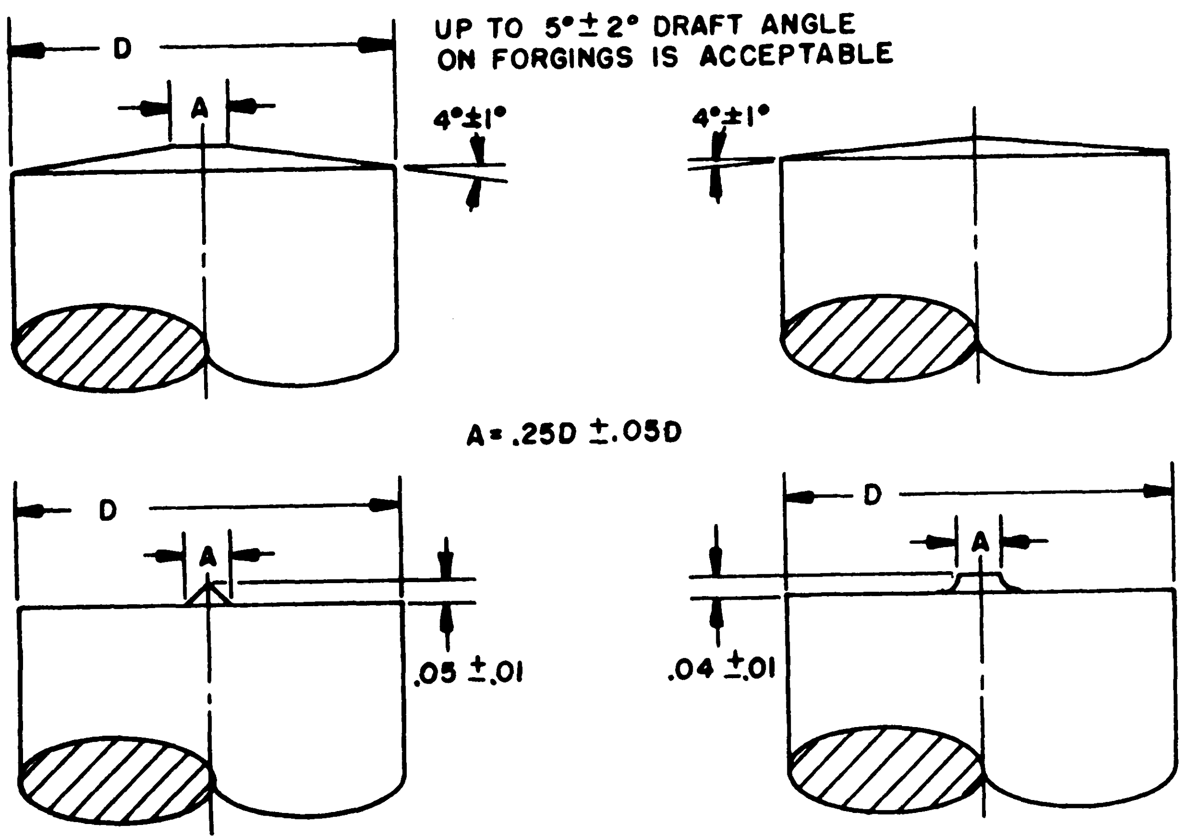


4.6.2.4 Nondestructive testing when specified shall be shown as part of weld symbols in accordance with AWS A2.2. Nondestructive Testing Symbols.

4.6.3 Type I, class A welds (see 1.2), having no unwelded area at the center, may be reliably obtained when a suitable center projection feature is provided on one component. It is desirable, for cost reduction, to use the configuration method which is most economically produced by the processing method involve (forging, cold heading, machining.) For examples see Figure VI.

FIGURE VI

STANDARD CENTER PROJECTION DESIGNS



4.6.4 Surface Preparation. Unless otherwise specified on drawings the weld surfaces shall be prepared as specified herein.

4.6.4.1 The faying surfaces to be joined should be free from heavy mill or forging scale, or other contaminants such as paint and grease in amounts which would adversely affect welding parameters and weld quality. All surface treatments which produce an anti-friction action such as carburizing, surface hardening, nitriding, phosphating, chrome plating and cadmium plating should be removed.

4.6.4.2 Brittle phases are sometimes formed at the faying surface when welds are made of two different base materials, i.e., aluminum to steel. These brittle phases are the result of the formation of intermetallic compounds. The use of a thrust force sequence or of a final thrust higher than the initial thrust force has been used successfully to eliminate the intermetallics from the joint as flash.

4.7 Upset

4.7.1 Additional component length is required to compensate for the metal displaced during the welding operation. To produce the specified welded assembly length, additional stock equal to the amount of upset must be included in one component or it may be divided (in any proportion between the components) when the joint faying surfaces are matched. When unmatched components are to be welded, the upset allowance should be provided in the component having the smaller cross section at the interface.

4.7.2 The following calculated formulas to compensate for upset shall have a tolerance of $\pm$ 10% of the upset.

Solid Bar to Solid Bar - -
Upset = 0.05 inches + 0.1 X Diameter (inches)
Example (1 inch diameter):
Upset = 0.05 + 0.1 X 1 = 0.150 inches

Bar to Plate - -
Upset = 2/3 X Solid Bar Upset
Example (1 inch diameter)
Upset = 2/3 X 0.150 = 0.100 inches

For prepared end designs, length of the projection shall be included as part of the upset. No distinction is made between upset requirements for prepared end design and flat end design.

Tube to Tube --
Upset = 0.150 inches + 0.2 X Wall Thickness (inches)
Example (0.2 inch wall thickness):
Upset = 0.150 + 0.2 X 0.2 = 0.190 inches.

Tube to Plate --
Upset = 2/3 X Tube - Tube Upset
Example (0.2 inch Wall Tube to Plate):
Upset = 2/3 X 0.190 = 0.126 inches

4.7.3 When the components are matched at the faying surfaces, components of identical composition will be displaced equally. For unlike compositions, the components displacement may be slightly disproportionate, however total displacement is within the standard amount of upset.

4.7.4 Deviations from the standard upset are permissible, when advantageous, for conditions peculiar to a particular application.

4.7.5 The weldment length is affected by the component length process tolerances as well as the upset tolerance. For more restrictive weldment length control than these would afford, it is necessary to provide additional component length and specify machining of the weldment.

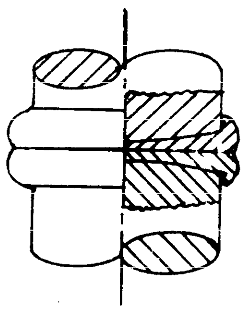
4.8 Flash.

4.8.1 When the weld flash would interfere with the function of the part or present an undesirable appearance, flash removal shall be specified. See Figure V for method of specifying flash removal. Note: Inertia Friction weld flash appearance is not objectionable per se. For maximum economy, specify flash removal only when necessary.

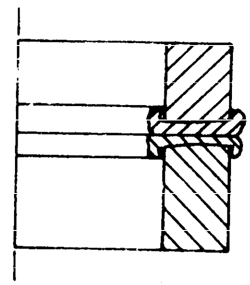
4.8.2 Figure VII illustrates the appearance of flash on various type joints.

FIGURE VII

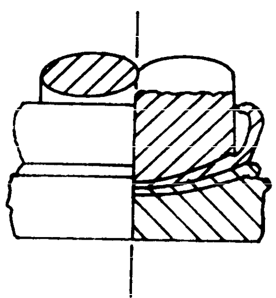
ILLUSTRATION OF FLASH



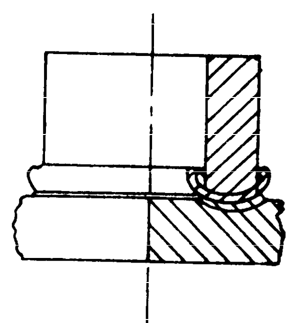
SOLID ROUND TO MATCHED SECTION



TUBE TO MATCHED TUBE



SOLID ROUND TO LARGER FLAT AREA

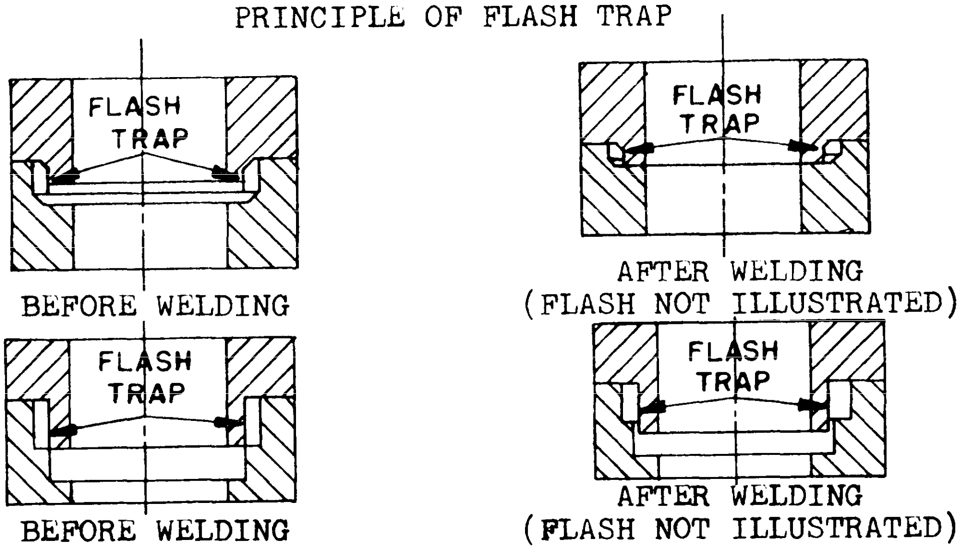


TUBE TO LARGER FLAT AREA

4.8.3 Flash is extruded equally inside and outside the bore when welding tubular components. If the inside flash is unacceptable and it cannot be removed because of inaccessibility, a flash trap shall be incorporated into the design. Figure VIII illustrates the principle of flash trap design.

FIGURE VIII

PRINCIPLE OF FLASH TRAP



4.8.4 For materials which produce a hardened flash upon cooling to room temperature, flash removal may be difficult. Removal may be done on a part which is still warm from welding. Also local softening of only the flash is permitted using induction or flame heating. Whether the weld flash is to be removed and the amount of removal shall be specified on the drawing. The extent of flash removal shall be based on the class of the weld.

5. Detail Requirements.

5.1 The inertia friction welding machine shall be capable of joining similar as well as dissimilar materials of known weld ability with a resultant forged bond equal in cross-section strength to the weakest parent material. These machines require work pieces which are designed with the faying surfaces concentric and usually perpendicular to the centerline between the headstock and tailstock, with the axis of the rotating work piece being coincident with the centerline between the headstock and the tailstock. The length of material upset (shortening) transferred to the workpiece by application of the thrust force shall be predictable and repeatable for the type and size material being worked, and upset shall be held to within two percent of set values.

5.1.1 Revolutions per minute and pressure shall be controlled by suitable means within the tolerances shown below.

Revolution pre minute: ± 1.0%
Pressure: ± 50.0 psig

Instruments used for indicating and controlling revolutions per minute and pressure shall be calibrated and maintained on a regular schedule.

5.1.2 Machine certification to verify performance repeatability shall be achieved by making satisfactory welds in accordance with the requirements of 5.1.2.1 through 5.1.2.3. A machine which has been previously certified under MIL-W-80244 and on which a written record is available will be considered as certified and not require recertification.

5.1.2.1 Weld specimen. The specimen joint shall be composed of two solid pieces of AISI 1018 material of the same diameter and three inches minimum in length. The exact diameter is dependent upon the maximum rated diameter for the appropriate machine. The joint shall be formed by inertia welding the circular cross sectional area.

5.1.2.2 Inertia friction weld a minimum of five specimens (AISI 1018) as described in 5.1.2.1. Welds shall meet the requirements of 5.1.3.

5.1.2.3 Each machine shall be certified for two sizes of sample joints and the certification of that machine shall be limited to the faying surface area range represented by those two samples. Recertification of the machine is required for welding of joints out of the certified range. A written record of certification will be maintained.

5.1.3 Weld quality.

5.1.3.1 Two test joints shall be sectioned, polished, etched, and metallographically examined at 100x magnification. Weld heat affected zone shall be uniform across the bond line. The bond or weld line shall be uniform and free from any indications of unbonded areas or inclusions.

5.1.3.2 Welding equipment previously qualified and approved on which a record is available and qualification has been retained shall not require requalification.

5.2 Welding Procedures.

5.2.1 Prior to beginning production welding, a qualified welding procedure shall be established for each machine production welded joint. Qualification of the procedure shall be accomplished when a minimum of five production or simulated production joints of the same material are welded. The welds shall meet the requirements of 5.2.2 and 5.2.3.

5.2.2 When non-destructive tests are required in the contract or order, drawings or detail specification, all tests shall meet the requirements of these tests.

5.2.3 When mechanical tests are required in the contract or order, drawings or detail specifications, a minimum of three test samples shall meet the requirements of these tests.
A minimum of two test samples will be sectioned for macroscopic examination (10-30X) of the weld zone.

5.2.4 A welding procedure sheet, see Example I, shall be prepared to cover each inertia friction welding application. Each sheet shall be kept for reference purposes. When similar welding procedures appear, previously approved procedure sheets shall be utilized for their welding data.

5.2.5 Welding procedures, once established, that produce a part that met the requirements specified in the contract or order, drawings or detail specifications, shall be the qualified procedure for that part.

5.2.6 Requalification of welding procedures shall be required when any of the following changes occur.

A. Joint Geometry

(1) Any change in the joint preparation exceeding ± 10 degrees from the preparation qualified.
(2) A change in the cross-sectional area of the weld joint greater than ± 10% of the area qualified.
(3) A change in the outside diameter of the cylindrical weld interface of the assembly greater than ± 10% of the outside diameter qualified.
(4) A change from solid to tubular cross section at the joint or vice versa.
(5) Any change in the faying surface condition - example noncarburized to carburized.

B. Welding Parameters

(1) A change in rotational speed producing a change in surface velocity greater than + 10% of the surface velocity (in ft/min) qualified.
(2) A change in the thrust force (lb) greater than + 10% of the thrust force qualified.
(3) A change in the flywheel energy (lb - ft^2) greater than + 10% of the flywheel energy qualified.
(4) Any change in upset dimensions (overall loss in length of parts being joined) greater than + 10% of the upset qualified.

5.2.7 Welding procedures previously qualified and approved on which a record in available and qualification has been retained shall not require requalification.

5.3 Operator Qualification.

5.3.1 The operator shall be a qualified machine operator and shall be considered qualified if he has prepared the welding procedures and set up the machine to produce weld samples for machine certification (see 5.1). The operator may qualify if he is able to set up the welder and establish welding procedures to comply with 5.2. If the certified machine is set up to weld production parts using a qualified welding procedure (see 5.2), the operator may also qualify if he can produce parts that are in accordance with the contract or order, drawing or detail specification.

5.3.2 Procedures and machine operators previously qualified and approved on which records are available and qualifications have been retained shall not require requalification.

5.4 Workmanship. Weld joints shall be uniform in quality and configuration, sound and free from cracks, lack of fusion and discontinuities detrimental to the fabrication or performance of the parts.

5.5 Mechanical Properties. When mechanical properties requirements are specified by the procuring activity, inertia welded joints shall meet the mechanical properties requirements shown in the contract or order, drawing or detail specification. Unless otherwise specified, the material shall be tested in accordance with the applicable testing methods of Fed. Test Method Std. No. 151, MIL-STD-418, ASTM-A370 or AWS-A4.0.

EXAMPLE I

Procedure: Include the following in a written form

Machine: Type

Certification: Date and Range

Spindle Velocity: RPM

Thrust Load: Pounds initial and pounds final if different

Inertial Mass: Pounds-Feet^2

Weld Energy: Foot-Pounds

Upset: Inches

Faying Surface Area: Inches^2

Base Material: Type of material and Thermal Condition

Type of Joint: Five (5) basic types, Dimensions and angles

Post Weld Operations: Post heat, stress relieving, heat treating, and upset removal

Faying Surface Preparation: How cleaned, if cleaned

Type of Inspection- Class of Weld:

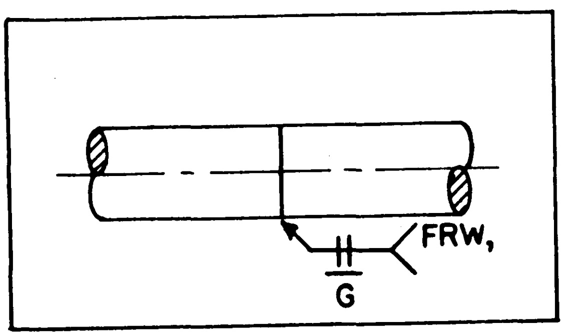


DIAGRAM OR CROSS-SECTION OF JOINT

5.6 Magnetic Particle Inspection. When magnetic particle inspection is specified in the contract or order, drawing or detail specification it shall be carried out in accordance with MIL-I-6868, MIL-I-6870, SNT-TC-1A, ASTM-E109, ASTM-E125, ASTM-E138 or AWS-B1.1.

5.7 Radiographic Inspection. When specified in contract or order, drawings or detail specification, inertia welded joints shall be subject to radiographic inspection in accordance with MIL-STD-453, MIL-I-6870, MIL-R-11470, SNT-TC-1A, ASTM-E94, ASTM-E99 or AWS-B1.1.

5.8 Dye Penetrant Inspection. When dye-penetrant inspection is specified in the contract or order, drawings or detail specification, inertia weld joints shall be subject to dye-penetrant inspection in accordance with MIL-I-6866, MIL-I-6870, SNT-TC-1A, ASTM-E165 or AWS-B1.1.

5.9 Eddy-Current Testing. When eddy-current testing is specified in the contract or order, drawing or detail specification, inertia weld joints shall be subject to eddy-current testing in accordance with MIL-I-6870, SNT-TC-1A or ASTM-E309.

5.10 Ultrasonic Testing. When ultrasonic testing is specified in the contract or order, drawing or detail specification, inertia weld joints shall be subject to ultrasonic testing in accordance with MIL-I-6870, MIL-I-8950, SNT-TC-1A, ASTM-E164 or AWS-B1.1.

5.11 Metallographic Examination. When metallographic examination is specified in the contract or order, drawing or detail specification, inertia weld joints shall be subject to metallographic examination in accordance with ASTM-E3, ASTM-E112 or AWS-B1.1.

5.12 Hardness. Hardness, when specified in the contract or order, drawing or detail specification, shall be tested in accordance with ASTM-A370, ASTM-E10 or ASTM-E92.

6. Intended use. The inertia welding process described herein is to be used for the joining of parts which have at least one member with configuration that can be rotated. Joints involving similar and dissimilar ferrous and non-ferrous alloys, including superalloys, may be assembled using this process. Weld configurations that may be welded using this process are bar to bar, bar to tube, bar to plate, tube to tube and tube to plate.

Custodians:
Army - WC
Navy - SH

Reviewer:
Army - AT, EA, MI, MR, PA

User:
Army - AV, EL, MU, WV

Preparing activity:
Army - WC

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DOCUMENT IDENTIFIER AND TITLE MIL-STD-1252 Inertia Friction Welding Process, Procedure and Performance Qualification

NAME OF ORGANIZATION AND ADDRESS	CONTRACT NUMBER
	MATERIAL PROCURED UNDER A ☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

   A. GIVE PARAGRAPH NUMBER AND WORDING.

   B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES

2. COMMENTS ON ANY DOCUMENT REQUIREMENT CONSIDERED TOO RIGID

3. IS THE DOCUMENT RESTRICTIVE?

   ☐ YES ☐ NO *(If "Yes", in what way?)*

4. REMARKS

SUBMITTED BY *(Printed or typed name and address - Optional)*	TELEPHONE NO.
	DATE

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