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MILITARY STANDARD

Fittings, Flareless, Classification of Defects of

FSC MISC

DEPARTMENT OF DEFENSE
Washington, D.C. 20360

Fittings, Flareless, Classification of Defects of

MIL-STD-1655

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:

Commanding Officer
Naval Air Engineering Center
Engineering Specifications and Standards Department
(Code 931)
Lakehurst, New Jersey 08733

CONTENTS

FOREWARD

This standard implements for the Department of Defense a classification of defects of flareless fittings to the effect they have on safety and usability.

1. SCOPE

1.1 General - This standard establishes a classification of commonly occurring defects applicable to the flareless fitting drawings specified in MIL-F-18280.

1.2 Purpose - For each requirement of the specification, design standards, and fitting standards this document lists defects and, opposite them, an applicable defect number.

2. REFERENCED DOCUMENTS

2.1 The issues of the following documents in effect on the date of invitation for bids form a part of this standard to the extent specified herein.

SPECIFICATIONS

Military

MIL-F-18280	Fittings, Flareless Tube, Fluid Connection

STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MS21900	Adapter, Flareless Tube to AN Flared Tube
MS21901	Adapter, Flareless Tube for 3/8 Bulkhead and Universal to AN Flared Tube
MS21902	Union, Flareless Tube
MS21903	Union, Flareless Tube, 3/8 Bulkhead and Universal
MS21904	Elbow, Flareless Tube, 90°
MS21905	Tee, Flareless Tube
MS21906	Cross, Flareless Tube
MS21907	Elbow, Flareless Tube and Universal 45°
MS21908	Elbow, Bulkhead Universal 90 Deg., Flareless Tube
MS21909	Tee, Bulkhead and Universal, Flareless Tube

STANDARDS (Continued)

Military (Continued)

MS21910	Tee, Flareless Tube, Internal Thread on Side
MS21911	Tee, Bulkhead Flareless Tube, Internal Thread on Run
MS21912	Tee, Flareless Tube With Bulkhead on Run
MS21913	Plug, Flareless Tube
MS21914	Cap, Pressure Seal, Flareless Tube Fitting
MS21915	Bushing, Screw-Thread Expander, Flareless Tube Connection
MS21916	Reducer, External Thread, Flareless Tube
MS21921	Nut, Sleeve Coupling, Flareless
MS21922	Sleeve, Coupling, Flareless
MS21923	Adapter, Flareless Tube, Bulkhead and Universal to Flared Tube
MS21924	Union, Flareless Tube, Bulkhead and Universal
MS21925	Elbow, 90° Universal, Flareless Tube, High Profile
MS21926	Elbow, 90° Universal, Flareless Tube, Low Profile
MS21932	Fitting End, Bolt Cluster Fitting, Single Port
MS21933	Fitting End, Bolt Cluster Fitting, Single Port Through, Flareless
MS21934	Fitting End, Bolt Cluster Fitting, Double Port
MS21935	Fitting End, Bolt Cluster Fitting, Double Port, Through, Flareless

STANDARDS (Continued)

Military (Continued)

MS21936	Contour and Mounting End, Cluster Fitting Body, Semifinished
MS21937	Nut, Cluster Fitting, Retainer
MS21938	Bolt, Cluster Fitting, Single Port, Flareless
MS21939	Bolt, Cluster Fitting, Single Port, Through, Flareless
MS21940	Bolt, Cluster Fitting, Double Port, Flareless
MS21941	Bolt, Cluster Fitting, Double Port, Through, Flareless
MS21942	Body, Cluster Fitting, One Way, Flareless
MS21943	Body, Cluster Fitting, Two Way, 90°, Flareless
MS21944	Body, Cluster Fitting, Two Way, 180°, Flareless
MS21945	Body, Cluster Fitting, Three-way, Flareless
MS24385	Fitting End, Flared Tube Connection, Precision Type, Standard Dimensions
MS24405	Adapter, Flareless Tube to AN Flared Tube, Precision Type
MS24651	Elbow, Tube - 90°, Bulkhead, Flareless Tube Universal to Flared Tube
MS24652	Elbow, Tube - 90°, Bulkhead, Flared Tube Universal to Flareless Tube
MS24654	Elbow, Tube - 45°, Bulkhead, Flareless Tube Universal to Flared Tube

STANDARDS (Continued)

Military (Continued)

MS33514	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
MS33515	Fitting End, Standard Dimensions for Bulkhead Flareless Tube Connections
MS33649	Bosses, Fluid Connection, Internal Straight Thread
MS33656	Fitting End, Standard Dimensions for Flared Tube Connection and Gasket Seal
MS33657	Fitting End, Standard Dimensions for Bulkhead Flared Tube Connection

OTHER PUBLICATIONS

Air Force - Navy Aeronautical Bulletin

ANA 431	AN Fittings, Classification of Defects of

(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.)

3. DEFINITIONS

3.1 Definition of classes shall be in accordance with MIL-STD-109. However, minor defects as defined in MIL-STD-109 are further categorized as follows:

MINOR A - May leave a slight effect on usability.
MINOR B - Has essentially no effect on usability.

4. GENERAL REQUIREMENTS

4.1 Classification of defects - Defects are herein considered for classification in accordance with the effect they have on safety and usability.

4.2 Acceptability of classifications - These classifications shall govern the acceptance inspection of fittings when so indicated in the fitting specification or drawing or in the procurement document, and shall be applied to inspection of fittings manufactured under such specifications or drawings.

4.3 Sampling - When acceptance inspection for these parts is done by sampling, the sampling plan will be specified in the appropriate procurement document. Sampling shall be in accordance with MIL-STD-105, and the following AQL's shall apply:

MAJOR - 1.5
MINOR A - 4.0
MINOR B - 6.5

4.3.1 AQL's shall be applied by class of defects.

5. DETAILED REQUIREMENTS

5.1 Classification of defects for design standards MS21932, MS21934, MS24385, MS33649, MS33656, and MS33657 will be found in ANA 431.

5.2 MS33514 Flareless End Design

Class	Defect No.	Characteristic
Major	101	X - Distance from gauge dia to tube stop
Minor A	201	T Thread - To specification
	202	24^{o} - Seat angle
	203	Surface Finish - Seat
	204	F Dia - Undercut dia
	205	Surface Finish - F Dia
	206	W - Squareness of face to threads
	207	Q - Undercut width
	208	Concentricity - Seat to threads
Minor B	301	A Dia - I. D.
	302	D Dia - Tube stop to seat dia
	303	75^{o} - Tube stop angle
	304	E - Distance across hex flats
	305	H - Seat depth
	306	J - Thread or end length
	307	K - Hex chamfer dia
	308	M Rad - I. D. at tube stop
	309	V Rad - Corner at tube stop
	310	Y Dia - Thread chamfer dia
	311	Radius - F dia and hex face
	312	15^{o} - Hex chamfer angle
	313	45^{o} - Thread chamfer angle
	314	Imperfect threads
	315	Radius - Thread chamfer at F dia
	316	Concentricity - F dia to thread

5.3 MS21922 Sleeve

Class	Defect No.	Characteristic
Major	101	Sharp Cutting Edge

Class	Defect No.	Characteristic
Minor A	201	B - Distance from shoulder back to pilot end
	202	D Dia - O. D. of tail
	203	E Dia - I. D.
	204	G Dia - O. D. of barrel
	205	.020 Rad - Front of shoulder and barrel
	206	35° - Shoulder angle
	207	Surface Finish - Shoulder, ID, and cutting edge
	208	Concentricity - D. E. F. and G dias
Minor B	301	A - Overall length
	302	C - Width of shoulder
	303	H Dia - O. D. of shoulder
	304	J Dia - I. D. of pilot after spinning
	305	Radius - I. D. and O. D. at tail
	306	Radius - Shoulder angle and tail
	307	.030 - Groove width
	308	.030 - Groove location from shoulder
	309	.010/.005 - Groove depth
	310	12° - Pilot angle after spinning
	311	Break edges and remove burrs
	312	Marking - Per specification
	313	Finish - Per specification

Note: The following characteristics are not inspectable after spinning the pilot over to 12° after machining:

F Dia - I. D. of pilot before spinning
K - Distance from edge to pilot end
R Rad - Edge and pilot ID
S Rad - Barrel O. D. at pilot end
2° - Cutting edge angle

5.4 MS33515 Bulkhead Flareless End Design

Class	Defect No.	Characteristic
Major	101	X - Distance from gauge dia to tube stop
Minor A	201	T Thread - To specification
	202	24° - Seat angle

Class	Defect No.	Characteristic
	203	Surface Finish - Seat
	204	F Dia - Undercut dia
	205	Surface Finish - F dia
	206	W - Squareness of face to threads
	207	N - Undercut width
	208	Concentricity - Seat to threads
	209	Continuation of same thread lead
Minor B	301	A Dia - I. D.
	302	D Dia - Tube stop to seat dia
	303	75^{o} - Tube stop angle
	304	E - Distance across hex flats
	305	H - Seat depth
	306	K - Distance from shoulder to seat end
	307	E Dia - Hex chamfer dia
	308	M Rad - I. D. at tube stop
	309	V Rad - Corner at tube stop
	310	Y Dia - Thread chamfer dia
	311	Radius - G Dia and shoulder
	312	15^{o} - Hex chamfer angle
	313	45^{o} - Thread chamfer angle
	314	L or .031 - Shoulder length
	315	Radius - Thread chamfer at F and G dias
	316	Concentricity - F dia to thread
	317	R - Flange width
	318	S Dia - Flange dia
	319	J Dia - Shoulder dia
	320	P - Distance from center undercut to seat end
	321	G Dia - Back undercut dia
	322	Q - Back undercut width
	323	Radius - J dia and flange

5.5 MS21921 Nut

Class	Defect No.	Characteristic
Minor A	201	T Thread - To specification
	202	E Dia - Small I. D.
	203	Concentricity - E and K dias to thread

Class	Defect No.	Characteristic
Minor B	301	A - Overall length
	302	B - O. D. turn length
	303	20^{o} - Hex chamfer angle at B length
	304	15^{o} - Hex chamfer angle at tail
	305	Diameter - Hex chamfer dia at tail
	306	C Dia - O. D. turn dia
	307	.016 - Corner break width on C dia
	308	45^{o} - Corner break angle on C dia
	309	D Dia - Thread chamfer dia
	310	90^{o} - Thread chamfer angle
	311	F - Full thread length
	312	G - Distance from inside shoulder to front
	313	K Dia - Internal 45^{o} seat dia
	314	45^{o} - Internal seat angle
	315	Surface Finish - Internal 45^{o} seat
	316	Radius - Seat angle and E dia
	317	.005 - Corner break width at E dia and tail
	318	45^{o} - Corner break angle at E dia and tail
	319	Break edges and remove burrs
	320	Marking - Per specification
	321	Finish - Per specification

5.6 Shapes, Fittings such as Tees, Elbows, and Crosses, Produced from Forgings MS21904, MS21905, MS21906, MS21907, MS21908, MS21909, MS21910, MS21911, MS21912, MS21925, MS21926, MS24651, MS24652, MS24654

Class	Defect No.	Characteristic
Major	101	Incomplete or missing holes
	102	Internal burrs
Minor B	301	Leg length, short flareless end
	302	Leg length, bulkhead flareless end
	303	Leg length, short flared end
	304	Leg length, bulkhead flared end
	305	Leg length, boss end
	306	Drill depth, short flareless end
	307	Drill depth, bulkhead flareless end
	308	Drill depth, short flared end
	309	Drill depth, bulkhead flared end

Class	Defect No.	Characteristic
	310	Drill depth, boss end
	311	Distance across wrench pads
	312	Angle between legs
	313	External corner radius of forgings on elbows
	314	Filet corner radius of forgings on O.D. of legs at intersections
	315	Radius at back of flange on bulkhead end
	316	Perfect thread depth on boss end
	317	O.D. dia of boss end
	318	Flange thickness at boss end
	319	K - Thread length of high profile flareless end (MS21925)
	320	K - End length of universal low profile flareless end (MS21926)
	321	Break edges and remove burrs
	322	Marking per specification
	323	Finish per specification

5.7 Straights, Fittings such as Unions, Reducers, Expanders, and Plugs Produced from Bar Stock MS21900, MS21901, MS21902, MS21903, MS21913, MS21915, MS21916, MS21923, MS21924, MS24405

Class	Defect No.	Characteristic
Major	101	Incomplete or missing holes
	102	Internal burrs
	103	Fitting end in accordance with MS33514, Style E and/or MS33656, Style E, except as shown and/or MS33515, Style E and/or MS33649
Minor B	301	Overall length
	302	Length, end to hex face, bulkhead flareless end
	303	Shoulder width, bulkhead flareless end
	304	Undercut width, flareless end (MS24405)
	305	Drill depth, short flareless end
	306	Drill depth, bulkhead flareless end
	307	Drill depth, internal port
	308	Distance across hex flats (MS21915)
	309	15° - Hex chamfer angle (MS21913, MS21915)
	310	Hex chamfer dia (MS21913, MS21915)
	311	Surface finish, undercut dia and hex face, flareless end (MS24405)
	312	Groove depth in hex corners

Class	Defect No.	Characteristic
	313	Groove position in hex corners
	314	Groove angle in hex corners
	315	Break edges and remove burrs
	316	Marking per specification
	317	Finish per specification
	324	Thread T to specification

5.8 MS21914 Cap Assembly

Class	Defect No.	Characteristic
Minor A	201	Nut free to swivel
Minor B	301	Thread damaged
	302	Retainer wire within hex limits
	303	L - Length of assembly
	304	Break edges and remove burrs
	305	Finish per specification

Note: The dimensional characteristics of the insert are not inspectable after assembly.

5.9 MS21933, Single Port Cluster Bolt End Design

Class	Defect No.	Characteristic
Major	101	K Dia - Sealing lands
	102	16 RHR Surface Finish - Sealing lands
Minor B	301	A - End length
	302	B - Length over lands
	303	C - Length to front land
	304	D - Cross hole position
	305	E - Length to back land
	306	F - Land chamfer length
	307	G Dia - Cross hole dia
	308	H Dia - Front undercut dia
	309	J Dia - Center relief dia
	310	L Dia - Back undercut dia
	311	45° - Back thread chamfer

Class	Defect No.	Characteristic
	312	.135/.090 - Front undercut width
	313	.056/.021 Rad - Front undercut radii
	314	.094/.031 Rad - Land chamfer radii
	315	30° - Land chamfers
	316	.026 Rad - Back undercut radius
	317	.052 - Back undercut width
	318	125 RHR Surface finish - Outside machined surfaces
	319	250 RHR Surface finish - Inside machined surfaces
	320	Concentricity - J dia to thread
	321	Concentricity - K dia to thread
	322	Concentricity - J dia to K dia
	323	.005 TIR Concentricity - Sealing lands

5.10 MS21935, Double Port Cluster Bolt End Design

Class	Defect No.	Characteristic
Major	101	M Dia - Sealing lands
	102	16 RHR Surface finish - Sealing lands
	103	.0005 TIR Concentricity - Sealing lands
Minor B	301	A - End length
	302	B - Length over lands
	303	C - Length to front land
	304	D - Length to front cross hole
	305	E - Length to front of center land
	306	F - Length to back of center land
	307	G - Length to back cross hole
	308	H - Length to back land
	309	J Dia - Front undercut dia
	310	K Dia - Cross hole dias
	311	L Dia - Relief dias
	312	N Dia - Back undercut dia
	313	P - Land chamfer length
	314	45° - Back thread chamfer
	315	.090/.135 - Front undercut width
	316	.056/.021 Rad - Front undercut radii
	317	.094/.031 Rad - Land chamfer radii
	318	30° - Land chamfers
	319	.026 Rad - Back undercut radius
	320	.052 - Back undercut width

Class	Defect No.	Characteristic
	321	125 RHR Surface Finish - Outside machined surfaces
	322	250 RHR Surface Finish - Inside machined surfaces
	323	Concentricity - L dia to thread
	324	Concentricity - M dia to thread

5.11 MS21936 Cluster Body Design

Class	Defect No.	Characteristic
Major	101	F Dia - Land dias
	102	32 RHR Surface Finish - O-ring grooves
Minor A	201	Squareness - Sides to F dia
Minor B	301	A Rod - O.D. of body
	302	B Rod - Max envelope of body
	303	C - Max envelope of legs
	304	D - Max envelope of legs
	305	E Rad - Rad between legs
	306	G Dia - O-ring groove dia
	307	H - Body thickness
	308	J - Center recess dia
	309	K - Center recess location
	310	L - O-ring groove location
	311	M - O-ring groove width
	312	.008/.002 Rad - Corner rad, O-ring groove
	313	.041/.021 Rad - Bottom rad, O-ring groove
	314	7^{o} - Sides of O-ring groove
	315	.125/.062 Rad - Bottom of center recess
	316	.031 Rad - Corner of body
	317	.406/.047 Rad - Corner of leg and body
	318	.409/.219 Rad - Corner of leg and body
	319	Concentricity - F and G dias

5.12 MS21937 Nut

Class	Defect No.	Characteristic
Minor A	201	T Thread - To specification

Class	Defect No.	Characteristic
Minor B	301	A - Overall length
	302	B Dia - Hex chamfer dia
	303	C Dia - Countersink dias
	304	D - Angle of lockwire hole
	305	E Dia - Counterbore dia
	306	F Dia - Outside turn dia
	307	H - Distance across hex flats
	308	.156 - length of outside turn dia
	309	15^{o} - Angle of hex chamfer
	310	.031 Rad - Corner of hex chamfer and turn dia
	311	45^{o} - Angle of countersink
	312	.165/.125 - Length of counterbore
	313	.062 Dia - Lockwire hole dia
	314	.031 - Position of lockwire hole
	315	Break edges and remove burrs
	316	Marking - Per specification
	317	Finish - Per specification

5.13 Cluster Bolts, Single and Double Port MS21938, MS21939, MS21940, MS21941

Class	Defect No.	Characteristic
Major	101	Incomplete or missing holes
	102	Internal burrs
Minor B	301	Overall length
	302	Drill depth past cross hole
	303	Drill depth, short flareless end
	304	Drill depth, long flareless end
	305	Drill hole dia
	306	Hex chamfer angle
	307	Hex chamfer dia
	308	Surface finish, outside machined surfaces
	309	Surface finish, inside surfaces
	310	Break edges and remove burrs
	311	Marking per specification
	312	Finish per specification

5.14 Cluster Bodies, One, Two, and Three Way MS21942, MS21943, MS21944, MS21945

Class	Defect No.	Characteristic
Major	101	Incomplete or missing holes
	102	Internal burrs
Minor B	301	Leg length
	302	Leg position to side of body
	303	Leg turn length
	304	Chamfer angle at body and leg
	305	Radius at body and leg
	306	Chamfer dia at body and leg
	307	Angle between legs
	308	Surface finish machined surfaces
	309	Break edges and remove burrs
	310	Marking per specification
	311	Finish per specification

Custodians:

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Navy - AS
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