

NOTE.—The Institution desires to call attention to the fact that this Specification is intended to include the technical provisions necessary for the supply of the articles herein referred to, but does not purport to comprise all the necessary provisions of a contract.

**BRITISH STANDARDS INSTITUTION.**

INCORPORATED BY ROYAL CHARTER 1929.

28 VICTORIA STREET, WESTMINSTER, LONDON, S.W. 1.

*British Standard Specification for Aircraft Material.*

**FORK JOINTS.**

**(Low Tensile Type.)**

**(For Sizes No. 4 B.A. to  $\frac{1}{2}$  inch B.S.F. inclusive.)**

**SPECIFICATION.**

NOTE. The order must state the material classification letter and part number of the fork joints required in accordance with Clause 5.

1. **Manufacture.** Fork joints may, at the option of the manufacturer, be made by machining either from bar or from blanks produced by the "cold heading" process. They shall be tapped either right hand or left hand as specified on the order.

2. **Screw threads.** The screw threads of coated fork joints in non-stainless steel and those of fork joints in stainless steel shall not be smaller than the minimum full, effective and core diameters specified in Table III of B.S. Specification No. 93 for British Association Threads, or Table 12 of B.S. Specification No. 84 for British Standard Fine Threads. The screw threads of all fork joints (those in non-stainless steel after being coated) shall be required to pass approved gauges.

3. **Anti-Corrosion coating.** The finished fork joints in non-stainless steel shall be uniformly coated with zinc or cadmium by an approved process. The thickness of the coating shall be not less than 0.0003 in. If the coating is electro-deposited the forks shall be heated to a suitable temperature between 100° C. and 200° C. for at least 30 minutes after-coating.

4. **Selection for testing.** Samples of fork joints may be selected at the discretion of the Inspector and tested as specified in Clause 5.

5. **Mechanical test.** The finished fork joints selected as specified in Clause 4 shall be screwed on to the wire as far as the inspection hole and the axial load shall be applied to a pin placed through the holes in the fork joint, no part of the fork joint being gripped in the testing machine. When loaded in this manner the fork joints shall show an ultimate tensile strength not less than that given in Table 1 (Col. 23) and Table 2 (Col. 23).

6. **Marking.** All fork joints shall have the appropriate part number applied on the shank near the tapped end by rolling and shall also bear the mark of the Inspector. If made of stainless steel they shall in addition be marked with the letter "Z" preceding the part number.

NOTE. For ordering purposes a letter "Y" shall be inserted in the Part Reference Number for non-stainless fork joints between the Specification Number and Part Number so as to distinguish clearly between non-stainless and stainless parts.

For example, the complete Part Reference Number for  $\frac{3}{16}$  in. non-stainless fork joint (left-hand thread) is SP. 3Y/420L and for stainless steel SP. 3Z/420L, while the corresponding markings on the actual fork joint will be 420L and Z/420L.

**FORK JOINTS MACHINED FROM BAR.**

7. **Material.** Fork joints machined from bar shall be made from steel bars which have been inspected and passed by the Inspector as complying with the latest issue of B.S. Specification S. 1, or where stainless steel is specified from the latest issue of one of the following B.S. Specifications, S. 61, S. 62 or S. 80.

8. **Manufacture.** Fork joints shall be machined bright all over.

9. **Design and dimensions.** All fork joints (those in non-stainless steel after coating) shall be in accordance with the dimensions and limits given in Tables 1 and 2, with the exception that those made in stainless steel shall have the collar (D) and projection (W) omitted.

**FORK JOINTS MADE BY THE "COLD HEADING" PROCESS (for SIZES 4 B.A. to  $\frac{7}{8}$  in. ONLY).**

10. **Material.** (a) The fork joints shall be machined from blanks made from steel of the following chemical compositions\* :—

Carbon	-	not less than 0.25 nor more than 0.35 per cent.
Silicon	-	not less than 0.10 nor more than 0.35 per cent.
Manganese	-	not less than 0.50 nor more than 0.90 per cent.
Sulphur	-	not more than 0.06 per cent.
Phosphorus	-	not more than 0.06 per cent.

(b) The complete analysis of every cast shall be supplied to the Inspector.

(c) When stainless steel fork joints are required, the steel shall comply with the chemical composition S. 61, S. 62 or S. 80.\*\*

11. **Manufacture.** The blanks shall be made by an approved process from material in a suitably softened condition.

12. **Design and dimensions.** All fork joints (those in non-stainless steel after coating) shall be in accordance with the dimensions and limits given in Table 2, with the exception that those made in stainless steel shall have the projection (W) omitted.

13. **Freedom from defects.** (a) The fork joints shall be free from defects.

(b) Any fork joint may be rejected at any time for faults in manufacture notwithstanding that it has been passed previously on chemical composition and mechanical tests.

14. **Heat treatment.** (a) All blanks before machining shall be hardened and tempered to the required ultimate strength.

(b) No blanks shall be re-hardened more than three times.

15. **Selection and preparation of mechanical test samples.** (a) Blanks hardened and tempered by a continuous process.

During each period of continuous heat treatment not exceeding 8 hours, at least one test sample shall be selected. This test sample shall be either one of the blanks of the largest diameter that has been treated during this period or a length of wire from which these blanks have been made, and which has been hardened and tempered with the blanks represented. The test pieces machined from the selected blanks or lengths of wire in accordance with Clause 16 (c) shall comply with the mechanical test requirements of Clause 16.

(b) Blanks hardened by a continuous process or in batches and tempered in batches comprising one tempering furnace charge.

Sufficient test samples shall be hardened with the blanks to enable at least one test sample to be tempered with each batch. This test sample may be either one blank of the largest diameter from the tempered batch or a length of wire from which the largest blanks in the tempered batch have been made. The test pieces machined from the selected blanks or lengths of wire in accordance with Clause 16 (c) shall comply with the mechanical test requirements of Clause 16.

(c) If any test piece fails to meet the mechanical tests, two further samples selected as in paragraph (a) or (b) above shall be submitted to the mechanical tests specified in Clause 16. If either of these test pieces fails to meet the mechanical tests specified the blanks represented may be rejected or, at the request of the manufacturer, be re-heat treated and re-tested in accordance with Clause 8.

\* Steel of this composition is covered by B.S. 970 En. 5.  
 \*\* Steel with chemical composition of S. 61 is covered by En. 56A, S. 62 by En. 56 and S. 80 by En. 57 all of B.S. 970.

16. **Mechanical tests.** (a) All tests shall be carried out to the satisfaction of the Inspector.

(b) The mechanical properties of the material shall be as follows:—

- Ultimate Tensile Stress - Not less than 35 tons per sq. in.
- Elongation on 4  $\sqrt{A}$  - Not less than 15 per cent.
- Izod - Not less than 40 ft. lb.
- Nicked fracture - See paragraph (e) below.

(c) *Tensile test.* The tensile test pieces shall be machined from the selected samples to the dimensions of the largest possible size of the British Standard tensile test piece Fig. 1, 2, 3 or 4 of British Standard Specification No. 2 A 4. Alternatively, at the option of the manufacturer the tensile test may be made on the full cross section of the unmachined test sample.

(d) (i) *Izod test.* The Izod test pieces shall be machined from the selected samples to the dimensions of the British Standard notched bar test piece Fig. 7 or 10 of British Standard Specification No. 2 A 4 and tested in a 120 ft. lb. Izod machine.

(ii) When the dimensions of a test sample are such that neither of the British Standard notched bar test pieces can be made from it, the nicked fracture test (see paragraph (e)) shall be substituted for the Izod test.

(e) *Nicked fracture test.* A test piece, nicked or sawn so that the area of the portion to be fractured is not less than one-half of the original sectional area, must be free from defects when broken by a minimum number of blows.

17. **Hardness tests.** Hardness tests shall be carried out by an approved method on representative hardened and tempered blanks selected by the Inspector. When continuous tempering is employed the blanks shall be selected for hardness tests at regular intervals and when tempered in batches the blanks shall be selected from each tempered batch.

The hardness numbers obtained must indicate uniformity of heat treatment among the batches of blanks.

18. **Magnetic crack detection.** Each blank shall be subjected to an examination by means of an electro-magnetic crack detector of a type approved by the Deputy Director General of Aeronautical Inspection and shall be thoroughly inspected to verify freedom from cracks.

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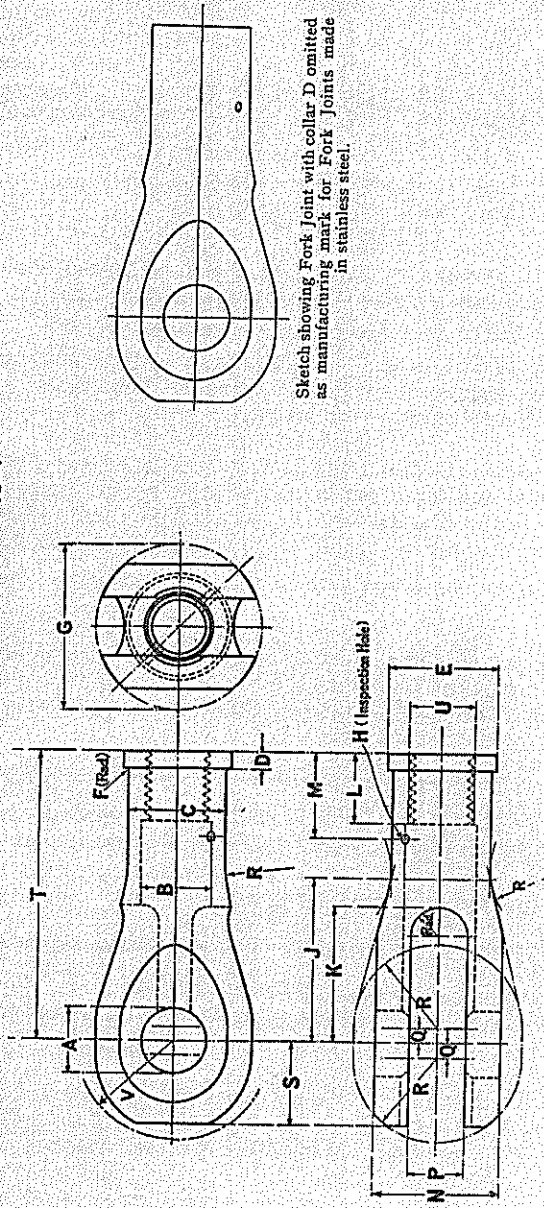
This Specification having been approved by the Aircraft Industry Committee was published by the authority of the Council of the Institution as a British Standard on 19th February, 1943.

NOTE.

*In order to keep abreast of progress in the Industries concerned, the British Standard Specifications are subjected to periodical review.*

*Suggestions for improvements, addressed to the Director of the British Standards Institution, 28 Victoria Street, London, S.W. 1, will be welcomed at all times. They will be recorded and in due course brought to the notice of the Committees charged with the revision of the Specifications to which they refer.*

Table 1.  
**FORK JOINTS.**  
(Low Tensile Type.)



Sketch showing Fork Joint with collar D omitted as manufacturing mark for Fork Joints made in stainless steel.

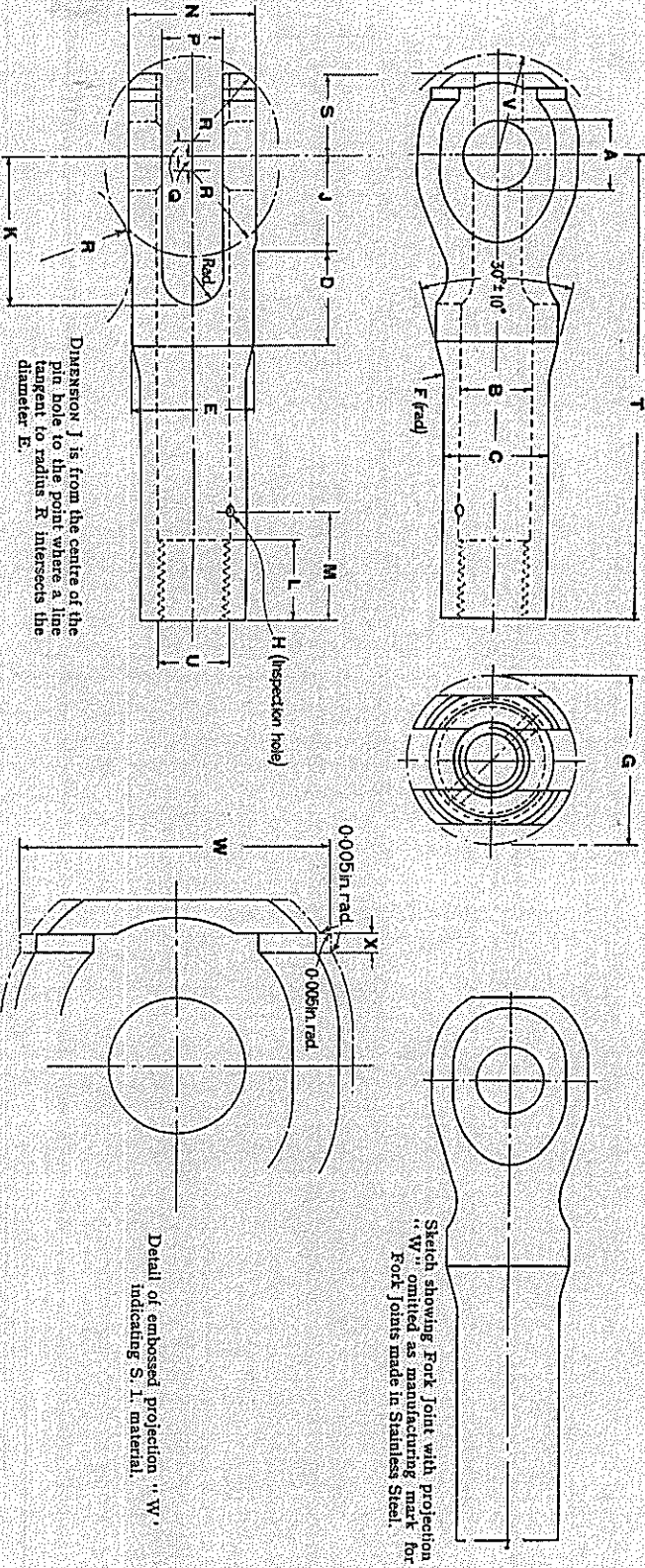
NOTES.—The centre of the pinhole A and the centre line of the slot P must be within 0.010 inch of the centre line of the Fork Joint. The Inspection Hole (H) must be drilled at right angles to the axis of the Fork Joint at the specified distance M from the end of the shank. Its actual position on the circumference of the shank may be determined by convenience of manufacture.

1 Part No. (See Footnote) Rt. Hd. Ld. Hd. Thd.	2 Size of Fork Joint.	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		A + .001" + .002"	B - 0 + .01"	C - 0 + .01"	D - 0 + .015"	E - 0 + .015"	F	G	H	J - 0 + .04"	K - 0 + .015"	L - 0 + .04"	M - 0 + .04"	N - 0 + .015"	P - 0 + .01"	Q - 0 + .01"	R	S - 0 + .01"	T - 0 + .04"	U Right-Hand or Left-Hand Thread.	V Pin Drill Rad. †	Minimum Tensile Strength.	Approx. Weight, † lb.	Part No. of Standard Steel Specification (See S. P. 4.)
412 412 L.	4 B.A.	$\frac{5}{32}$	$\frac{5}{32}$	.23	.07	.28	.05	$\frac{36}{16}$ - 0 + .015	$\frac{1}{8}$	.40	.35	.20	.30	.26	.10	.04	.18	.19	1.1	4 B.A.	.23	1155	.010	A 2
413 413 L.	2 "	$\frac{3}{16}$	$\frac{3}{16}$	.28	.08	.32	.05	$\frac{48}{16}$ - 0 + .015	$\frac{1}{8}$	.50	.40	.25	.35	.33	.15	.06	.24	.24	1.3	2 "	.31	2090	.016	B 3
411 411 L.	B.S.F. †7/32 in.	$\frac{7}{32}$	$\frac{15}{64}$	.34	.10	.40	.05	$\frac{56}{16}$ - 0 + .015	$\frac{1}{8}$	.53	.48	.25	.35	.42	.20	.05	.28	.27	1.5	$\frac{1}{2}$ in. B.S.F.	.34	2860	.030	C 5
414 414 L.	1/4 "	$\frac{1}{2}$	$\frac{17}{64}$	.385	.11	.48	.05	$\frac{62}{16}$ - 0 + .005	$\frac{1}{8}$	.60	.50	.30	.40	.48	.20	.08	.31	.30	1.5	$\frac{1}{2}$ "	.39	3795	.046	D 6
415 415 L.	†9/32 "	$\frac{9}{32}$	$\frac{19}{64}$	.44	.12	.50	.05	$\frac{72}{16}$ - 0 + .015	$\frac{1}{8}$	.78	.60	.30	.40	.58	.20	.08	.36	.34	1.7	$\frac{3}{8}$ "	.45	5115	.076	E 8
416 416 L.	5/16 "	$\frac{11}{32}$	$\frac{21}{64}$	.49	.12	.56	.05	$\frac{86}{16}$ - 0 + .015	$\frac{1}{8}$	.78	.70	.35	.45	.66	.25	.05	.43	.37	1.85	$\frac{1}{2}$ "	.50	6270	.104	G 10
417 417 L.	†11/32 "	$\frac{11}{32}$	$\frac{23}{64}$	.54	.15	.62	.05	$\frac{90}{16}$ - 0 + .015	$\frac{1}{8}$	.78	.70	.35	.45	.73	.25	.09	.45	.39	1.90	$\frac{11}{16}$ "	.55	7865	.135	G 11
418 418 L.	†3/8 "	$\frac{13}{32}$	$\frac{25}{64}$	.58	.15	.66	.05	$\frac{100}{16}$ - 0 + .005	$\frac{1}{8}$	.90	.80	.40	.50	.78	.30	.12	.50	.44	2.1	$\frac{3}{8}$ "	.62	9350	.168	J 12
419 419 L.	†13/32 "	$\frac{17}{32}$	$\frac{27}{64}$	.63	.15	.71	.05	$\frac{106}{16}$ - 0 + .005	$\frac{1}{8}$	1.05	.95	.45	.55	.78	.34	.13	.53	.54	2.35	$\frac{13}{16}$ "	.67	11275	.208	K 12
420 420 L.	†7/16 "	$\frac{15}{16}$	$\frac{33}{64}$	.68	.15	.76	.05	$\frac{114}{16}$ - 0 + .015	$\frac{1}{8}$	1.1	1.0	.45	.55	.83	.36	.18	.57	.58	2.45	$\frac{7}{8}$ "	.74	12980	.250	L 13
421 421 L.	†15/32 "	$\frac{1}{2}$	$\frac{31}{64}$	.73	.15	.81	.05	$\frac{120}{16}$ - 0 + .015	$\frac{1}{8}$	1.25	1.1	.50	.60	.93	.38	.13	.60	.62	2.6	$\frac{15}{16}$ "	.74	15180	.298	M 15
422 422 L.	†1/2 "	$\frac{11}{16}$	$\frac{33}{64}$	.77	.15	.85	.05	$\frac{126}{16}$ - 0 + 0	$\frac{1}{8}$	1.3	1.17	.55	.65	.98	.40	.18	.63	.64	2.7	$\frac{1}{2}$ "	.81	17050	.334	N 16

\*The Institution recommends that these sizes be ultimately replaced by Fork Joints in high tensile steel.  
†The figures in Cols. 22 and 24 are given for the information of designers and not for purposes of inspection.  
‡These sizes are obsolescent and must not be used in new designs.  
Where Fork Joints are manufactured in Stainless Steel (S 61, S 62 or S 80) the Part Numbers must bear the prefix letter 'Z', e.g., Z/419, Z/412L.

ALTERNATIVE DESIGN OF LOW TENSILE FORK JOINTS FOR USE WITH THE "COLD HEADING" PROCESS OF MANUFACTURE.

Table 2.



Sketch showing Fork Joint with projection "W" omitted as manufacturing mark for Fork joints made in Stainless Steel.

Detail of embossed projection "W" indicating S. I. material.

DIMENSION J is from the centre of the pin hole to the point where a line tangent to radius R intersects the diameter E.

NOTES.—The centre of the pinhole A and the centre line of the slot P must be within 0.010 inch of the centre line of the Fork Joint. The inspection Hole H must be drilled at right angles to the axis of the Fork Joint at the specified distance M from the end of the shank. Its actual position on the circumference of the shank may be determined by convenience of manufacture.



P.D. 632

**Amendment No. 1: May, 1947**

to 3 S. P. 3: 1943

Fork Joints (low tensile type)

*Clause 3, Anti-corrosion coating.* The clause is to be amended to require that finished fork joints in non-stainless steel shall be uniformly coated with cadmium by an approved process; the words "zinc or" in line 2 are therefore to be deleted.