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INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J490

REV. SEP96

Issued 1920-03
Revised 1996-09

Superseding J490 OCT81

Submitted for recognition as an American National Standard

(R) BALL JOINTS

***Foreword*—**This document has been changed to comply with the SAE Technical Standards Board format.

1. ***Scope*—**This SAE Standard covers the general and dimensional data for various types of ball joints with inch threads commonly used on control linkages in automotive, marine, and construction and industrial equipment applications.

Inasmuch as the load carrying and wear capabilities of ball joints vary considerably with their design and fabrication, it is suggested that the manufacturers be consulted in regard to these features and for recommendations relating to application of the different types and styles available.

The inclusion of dimensional data in this standard is not intended to imply that all the products described are stock production sizes. Consumers are requested to consult with manufacturers concerning availability of stock production parts.

2. ***References***

2.1 **Applicable Publications—**The following publications form a part of this specification to the extent specified herein.

2.1.1 ANSI PUBLICATION—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ANSI B.1.1—Unified Inch Screw Threads (UN and UNR Thread Form)

2.1.2 ASTM PUBLICATION—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM B 117—Method of Salt Spray (Fog) Testing.

3. ***General Specifications***

3.1 **Dimensions and Tolerances—**Except for nominal sizes and thread designations which are inch values only, dimensions and tolerances are given in both U.S. customary and SI units, as designated. Tabulated dimensions shall apply to the finished parts, plated or otherwise processed, as specified by the user. Limits on hexagon or round bar shapes shall be within the commercial tolerance of the bar stock material from which the components are produced.

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3.2 Threads—Unified Standard Class 2A external threads and Class 2B internal threads shall apply to plain finish (unplated) parts. For externally threaded components with additive finish, the maximum diameters of Class 2A may be exceeded by the amount of the allowance; that is, the basic diameters (Class 2A maximum diameters plus the allowance) apply to an externally threaded part after plating. For internally threaded components with additive finish, the Class 2B diameters apply after plating. See ANSI B 1.1.

3.2.1 External threads shall be chamfered to a diameter 0.01 in (0.3 mm) less than the minor diameter to produce a length of chamfered or partial thread equivalent to ¾ to 1¼ times the pitch (rounded to a three-place decimal).

3.2.2 Internal threads shall be countersunk 90 degrees included angle to a diameter 0.01 in (0.3 mm) greater than the major diameter of the thread (rounded to a two-place decimal).

3.3 Material

3.3.1 BALL JOINTS—Ball joints are normally made from low carbon free machining steel. The ball stud and mating plug components of Types A, AL, B, and C and the ball sockets on Type G, Styles 3 and 4, ball joints shall be case hardened unless otherwise specified. For special application, ball joints can be produced from alloy steel, corrosion resistant steel, brass, bronze, or other materials.

3.3.2 CUSHIONING DISCS—Cushioning discs shall be Neoprene, Buna N rubber, or equivalent material.

3.4 Finishes—Unless otherwise specified, carbon steel ball joints shall be furnished with cadmium or zinc protective finish and shall meet the requirements of 32 h salt spray test in accordance with ASTM B 117, Method of Salt Spray (Fog) Testing. At manufacturer's option, a subsequent chromate treatment may be used. Plated, hardened carbon steel components of ball joints (subject to hydrogen embrittlement) shall be baked or otherwise processed to obviate such embrittlement.

3.5 Lubrication—Unless otherwise specified by user, ball joints shall be supplied with ball sockets suitably lubricated in accordance with manufacturer's practice.

3.6 Dust Covers—Where so specified by the user, Type G ball joints shall be supplied with an oil-resistant rubber shield of such construction as to prevent dirt and dust from entering the ball cavity. However, shields for Style 3 are available in sizes 5/8 and 3/4 only.

3.7 Workmanship—Ball joints must be free from burrs, loose scale, sharp edges, and any other defects which might affect their serviceability.

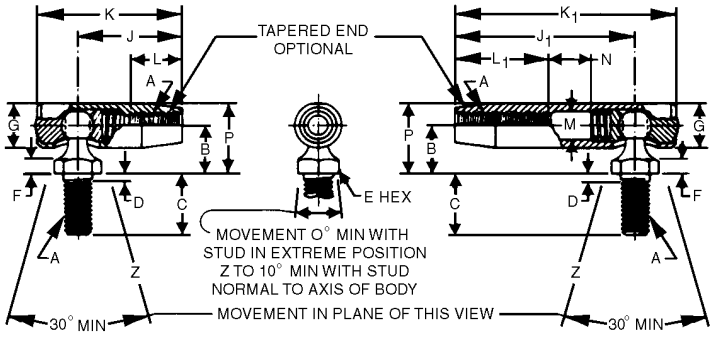


FIGURE 1—CRIMPED END PLUG WITH SPRING CONSTRUCTION—TYPE A

FIGURE 2—CRIMPED END PLUG WITH SPRING CONSTRUCTION—TYPE AL

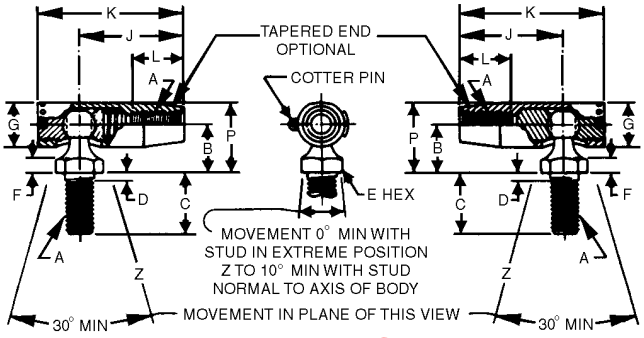


FIGURE 3—THREADED END PLUG WITH SPRING CONSTRUCTION—TYPE B

FIGURE 4—THREADED END PLUG WITHOUT SPRING CONSTRUCTION—TYPE C

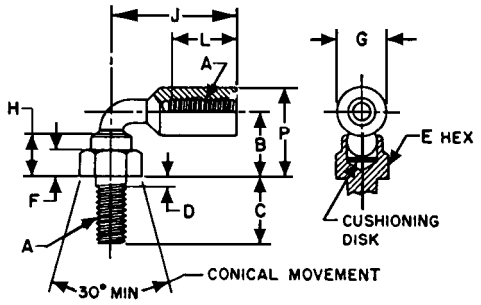
TABLE 1A—DIMENSIONS OF TYPES A, B, C AND ALL BALL JOINTS—B THROUGH J_1 (FIGURES 1 TO 4)

Nominal Ball Joint Size and Thread Diameter, A, in	Threads per in	B in ±0.02	B mm ±0.5	C in ±0.02	C mm ±0.5	D max in	D Max mm	E Hex in	E Hex mm	F Min in	F Min mm	G Dia in	G Dia mm	J in ±0.03	J mm ±0.8	J_1 in ±0.03	J_1 mm ±0.8
No. 10 0.190	32	0.44	11.2	0.44	11.2	0.06	1.5	0.312	7.92	0.12	3.0	0.38	9.7	0.88	22.3	1.50	38.1
No. 12 0.216	32	0.44	11.2	0.44	11.2	0.06	1.5	0.312	7.92	0.12	3.0	0.38	9.7	0.88	22.3	1.50	38.1
1/4 0.250	28	0.47	11.9	0.56	14.2	0.09	2.3	0.375	9.52	0.12	3.0	0.44	11.2	0.97	24.6	1.81	46.0
5/16 0.3125	24	0.53	13.5	0.69	17.5	0.09	2.3	0.438	11.12	0.16	4.1	0.50	12.7	1.12	28.4	1.94	49.3
3/8 0.375	24	0.69	17.5	0.88	22.3	0.09	2.3	0.500	12.70	0.19	4.8	0.62	15.8	1.38	35.0	—	—
7/16 0.4375	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0	1.94	49.3	—	—
1/2 0.500	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0	1.94	49.3	—	—

TABLE 1B—DIMENSIONS OF TYPES A, B, C AND ALL BALL JOINTS—K THROUGH P (FIGURES 1 TO 4)

Nominal Ball Joint Size and Thread Diameter, A in	K in ±0.03	K mm ±0.8	K_1 in ±0.03	K_1 mm ±0.8	L Min Full Thread mm 0.44	L Min Full Thread mm 11.2	L_1 Min Full Thread in 0.56	L_1 Min Full Thread mm 14.2	M Dia in +0.01 -0.00	M Dia mm +0.3 -0.0	N(1) (Ref) in	N(1) (Ref) mm	p(1) Max (Ref) in	p(1) Max (Ref) mm	Stud Ball Dia (Ref)(1) Max in	Stud Ball Dia (Ref)(1) Max mm	Stud Ball Dia (Ref)(1) Min in	Stud Ball Dia (Ref)(1) Min mm
No. 10 0.190	1.25	31.8	1.81	46.0	0.44	11.2	0.56	14.2	0.20	5.1	0.50	12.7	0.65	16.5	0.255	6.48	0.250	6.35
No. 12 0.216	1.25	31.8	1.81	46.0	0.50	12.7	0.88	22.3	0.23	5.8	0.50	12.7	0.65	16.5	0.255	6.48	0.250	6.35
1/4 0.250	1.38	35.0	2.25	57.2	0.56	14.2	1.00	25.4	0.27	6.9	0.50	12.7	0.72	18.3	0.305	7.75	0.300	7.62
5/16 0.3125	1.56	39.6	2.38	60.5	0.75	19.0	—	—	0.33	8.4	0.50	12.7	0.81	20.6	0.350	8.89	0.345	8.76
3/8 0.375	1.94	49.3	—	—	1.00	25.4	—	—	—	—	—	—	1.03	26.2	0.424	10.77	0.419	10.64
7/16 0.4375	2.62	66.5	—	—	1.00	25.4	—	—	—	—	—	—	1.28	32.5	0.555	14.10	0.550	13.97
1/2 0.500	2.62	66.5	—	—	1.00	25.4	—	—	—	—	—	—	1.28	32.5	0.555	14.10	0.550	13.97

1. These dimensions are given for design purposes only and are not intended for inspection.



TYPES D AND DS ARE NOT RECOMMENDED FOR APPLICATIONS INVOLVING TENSION OR SEVERE VIBRATION.

FIGURE 5—CUSHIONED TWO-PIECE CONSTRUCTION—TYPE D*

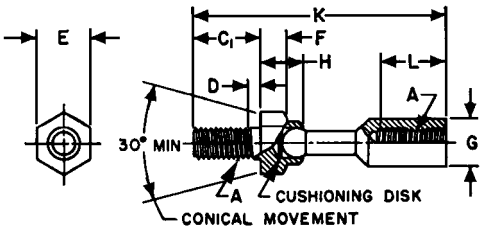


FIGURE 6—CUSHIONED TWO-PIECE CONSTRUCTION—TYPE DS*

TABLE 2A—DIMENSIONS OF TYPES D AND DS BALL JOINTS—B THROUGH F (FIGURES 5 AND 6)

Nominal Ball Joint Size and Thread Diameter, A, in		Thds per in	B in ±0.03	B mm ±0.8	C in ±0.02	C mm ±0.5	C_1 in ±0.02	C_1 mm ±0.5	D Max in	D Max mm	E Hex in	E Hex mm	F Min in	F Min mm
No. 10	0.190	32	0.53	13.5	0.44	11.2	0.56	14.2	0.06	1.5	0.375	9.52	0.19	4.8
No. 10	0.190	32	0.53	13.5	0.44	11.2	—	—	0.06	1.5	0.375	9.52	0.19	4.8
No. 12	0.216	24	0.53	13.5	0.56	14.2	0.56	14.2	0.06	1.5	0.375	9.52	0.19	4.8
No. 12	0.216	32	0.53	13.5	0.56	14.2	0.56	14.2	0.06	1.5	0.375	9.52	0.19	4.8
1/4	0.250	28	0.56	14.2	0.56	14.2	0.56	14.2	0.06	1.5	0.438	11.12	0.19	4.8
5/16	0.3125	24	0.69	17.5	0.69	17.5	0.69	17.5	0.09	2.3	0.562	14.28	0.28	7.1

TABLE 2B—DIMENSIONS OF TYPES D AND DS BALL JOINTS—G THROUGH P_1 (FIGURES 5 AND 6)

Nominal Ball Joint Size and Thread Diameter, A, in		Thds per in	G Dia in	G Dia mm	H in ±0.03	H mm ±0.8	J in ±0.03	J mm ±0.8	K in ±0.03	K mm ±0.8	L Min Full Thread in	L Min-Full Thread mm	P(1) Max (Ref) in	P(1) Max (Ref) mm
No. 10	0.190	32	0.28	7.1	0.33	8.4	1.03	26.2	2.03	51.6	0.50	12.7	0.70	17.8
No. 10	0.190	32	0.28	7.1	0.33	8.4	0.78	19.8	—	—	0.38	9.7	0.70	17.8
No. 12	0.216	24	0.28	7.1	0.33	8.4	1.03	26.2	2.03	51.6	0.50	12.7	0.70	17.8
No. 12	0.216	32	0.28	7.1	0.33	8.4	1.03	26.2	2.03	51.6	0.50	12.7	0.70	17.8
1/4	0.250	28	0.31	7.9	0.35	8.9	1.06	26.9	2.09	53.1	0.56	14.2	0.75	19.0
5/16	0.3125	24	0.44	11.2	0.45	11.4	1.31	33.3	2.63	66.8	0.69	17.5	0.94	23.9

1. These dimensions are given for design purposes only and are not intended for inspection.

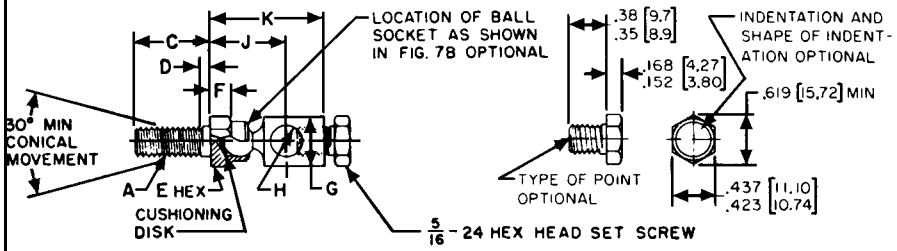


FIGURE 7A—TYPE DC—STYLE 1

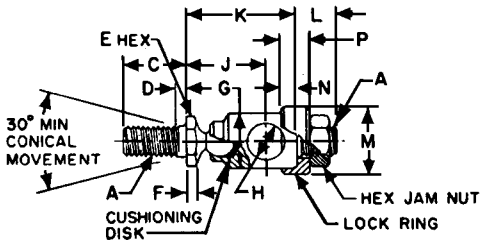


FIGURE 7B—TYPE DC—STYLE 2

TABLE 3A—DIMENSIONS OF TYPES DC BALL JOINTS—C THROUGH H (FIGURES 7A AND 7B)

Nominal Ball Joint Size and Thread Diameter, A, in	Thds per in	C in ±0.02	C mm ±0.5	D Max in	D Max mm	E Hex in	E Hex mm	F Min in	F Min mm	G Dia in	G Dia mm	H Dia in ±0.005	H Dia mm ±0.13
STYLE 1													
No. 10 0.190	32	0.31	7.9	0.06	1.5	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
1/4 0.250	20	0.44	11.2	0.09	2.3	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
1/4 0.250	20	0.56	14.2	0.09	2.3	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
1/4 0.250	28	0.44	11.2	0.09	2.3	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
1/4 0.250	28	0.56	14.2	0.09	2.3	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
5/16 0.3125	24	0.62	15.8	0.09	2.3	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
5/16 0.3125	24	0.75	19.0	0.09	2.3	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
3/8 0.375	24	0.62	15.8	0.09	2.3	0.438	11.12	0.19	4.8	0.50	12.7	0.323	8.20
STYLE 2													
No. 10 0.190	32	0.50	12.7	0.06	1.5	0.375	9.52	0.09	2.3	0.44	11.2	0.197	5.00
1/4 0.250	20	0.44	11.2	0.09	2.3	0.438	11.12	0.09	2.3	0.50	12.7	0.328	8.33
1/4 0.250	28	0.44	11.2	0.06	1.5	0.438	11.12	0.09	2.3	0.50	12.7	0.328	8.33
5/16 0.3125	24	0.62	15.8	0.09	2.3	0.438	11.12	0.11	2.8	0.56	14.2	0.380	9.65

TABLE 3B—DIMENSIONS OF TYPES DC BALL JOINTS—J THROUGH F (FIGURES 7A AND 7B)

Nominal Ball Joint Size and Thread Diameter, A, in		Thds per in	J in ±0.03	J in ±0.8	K in ±0.03	K mm ±0.8	L in ±0.2	L mm ±0.5	M Dia in	M Dia mm	N in ±0.01	N mm ±0.3	P in ±0.005	P mm ±0.13
STYLE 1														
No. 10	0.190	32	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
1/4	0.250	20	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
1/4	0.250	20	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
1/4	0.250	28	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
1/4	0.250	28	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
5/16	0.3125	24	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
5/16	0.3125	24	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
3/8	0.375	24	0.75	19.0	1.12	28.4	—	—	—	—	—	—	—	—
STYLE 2														
No. 10	0.190	32	0.62	15.8	0.78	19.8	0.40	10.2	0.56	14.2	0.12	3.0	0.250	6.35
1/4	0.250	20	0.78	19.8	1.02	25.9	0.34	8.6	0.62	15.8	0.12	3.0	0.250	6.35
1/4	0.250	28	0.78	19.8	1.02	25.9	0.34	8.6	0.62	15.8	0.12	3.0	0.250	6.35
5/16	0.3125	24	0.75	19.0	1.03	26.2	0.53	13.5	0.75	19.0	0.19	4.8	0.344	8.74

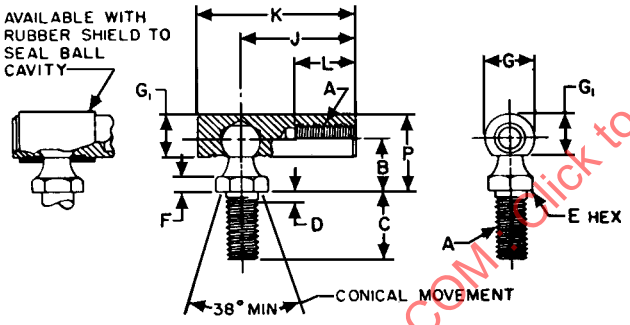


FIGURE 8A—TYPE G NONDETACHABLE CONSTRUCTION WITHOUT SPRING—STYLE 1

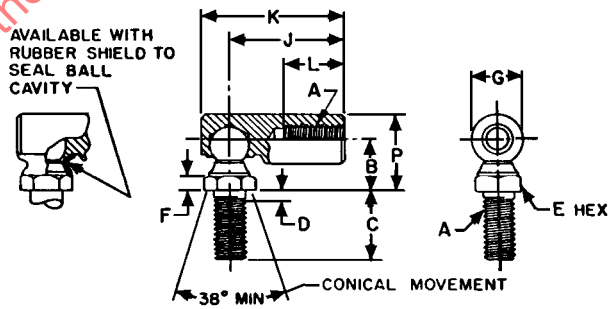


FIGURE 8B—TYPE G NONDETACHABLE CONSTRUCTION WITHOUT SPRING—STYLE 2

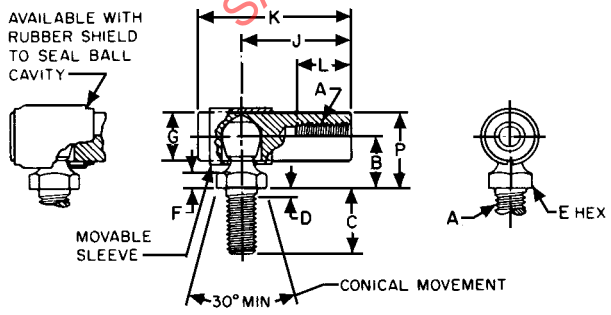


FIGURE 8C—TYPE G NONDETACHABLE CONSTRUCTION WITHOUT SPRING—STYLE 3[2]

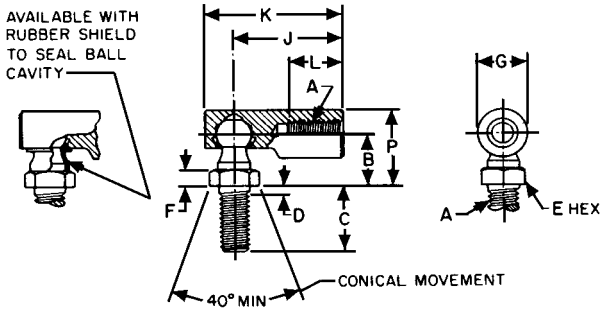


FIGURE 8D—TYPE G NONDETACHABLE CONSTRUCTION WITHOUT SPRING—STYLE 4[3]

TABLE 4A—DIMENSIONS OF TYPE G BALL JOINTS—B THROUGH G (FIGURES 8A-8D)

Nominal Ball Joint Size +and Thread Diameter, A, In	Thds per in	B in ±0.02	B mm ±0.5	C in ±0.02	C mm ±0.5	D Max in	D Max mm	E Hex in	E Hex mm	F Min in	F Min mm	G in	G mm
STYLE 1													
No. 10 0.190	32	0.44	11.2	0.44	11.2	0.06	1.5	0.312	7.92	0.12	3.0	0.38	9.7
1/4 0.250	28	0.47	11.9	0.56	14.2	0.06	1.5	0.375	9.52	0.12	3.0	0.44	11.2
5/16 0.3125	24	0.53	13.5	0.69	17.5	0.09	2.3	0.438	11.12	0.16	4.1	0.50	12.7
3/8 0.375	24	0.69	17.5	0.88	22.3	0.09	2.3	0.500	12.70	0.19	4.8	0.62	15.8
7/16 0.4375	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0
1/2 0.500	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0
STYLE 2													
No. 10 0.190	32	0.44	11.2	0.44	11.2	0.06	1.5	0.312	7.92	0.12	3.0	0.38	9.7
1/4 0.250	28	0.47	11.9	0.56	14.2	0.09	2.3	0.375	9.52	0.12	3.0	0.44	11.2
5/16 0.3125	24	0.53	13.5	0.69	17.5	0.09	2.3	0.438	11.12	0.16	4.1	0.50	12.7
3/8 0.375	24	0.69	17.5	0.88	22.3	0.09	2.3	0.500	12.70	0.19	4.8	0.62	15.8
7/16 0.4375	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0
1/2 0.500	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0
5/8 0.625	18	1.00	25.4	1.12	28.4	0.12	3.0	0.750	19.05	0.31	7.9	0.88	22.3
3/4 0.750	16	1.06	26.9	1.12	28.4	0.12	3.0	0.875	22.22	0.31	7.9	1.00	25.4
STYLE 3													
No. 10 0.190	32	0.44	11.2	0.44	11.2	0.06	1.5	0.312	7.92	0.12	3.0	0.38	9.7
1/4 0.250	28	0.47	11.9	0.56	14.2	0.06	1.5	0.375	9.52	0.12	3.0	0.44	11.2
5/16 0.3125	24	0.53	13.5	0.69	17.5	0.09	2.3	0.438	11.12	0.16	4.1	0.50	12.7
3/8 0.375	24	0.69	17.5	0.88	22.3	0.09	2.3	0.500	12.70	0.19	4.8	0.62	15.8
1/2 0.500	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.28	7.1	0.75	19.0
5/8 0.625	18	1.06	26.9	1.12	28.4	0.12	3.0	0.875	22.22	0.31	7.9	1.00	25.4
3/4 0.750	16	1.06	26.9	1.12	28.4	0.12	3.0	0.875	22.22	0.31	7.9	1.00	25.4
STYLE 4													
No. 10 0.190	32	0.47	11.9	0.44	11.2	0.06	1.5	0.375	9.52	0.12	3.0	0.44	11.2
1/4 0.250	28	0.47	11.9	0.56	14.2	0.09	2.3	0.375	9.52	0.12	3.0	0.44	11.2
5/16 0.3125	24	0.53	13.5	0.69	17.5	0.09	2.3	0.438	11.12	0.16	4.1	0.50	12.7
3/8 0.375	24	0.69	17.5	0.88	22.3	0.09	2.3	0.500	12.70	0.19	4.8	0.62	15.8
7/16 0.4375	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0
1/2 0.500	20	0.88	22.3	1.12	28.4	0.12	3.0	0.625	15.88	0.25	6.4	0.75	19.0
5/8 0.625	18	1.00	25.4	1.12	28.4	0.12	3.0	0.750	19.05	0.31	7.9	0.88	22.3

TABLE 4B—DIMENSIONS OF TYPE G BALL JOINTS—G_1 THROUGH P_1 (FIGURES 8A-8D)

Nominal Ball Joint Size and Thread Diameter, A, in		Thds per in	G_1 Min in	G_1 Min mm	J in ±0.02	J mm ±0.5	K in ±0.02	K mm ±0.5	L Min Full Thread in	L Min Full Thread mm	p(1) Max (Ref) in	p(1) Max (Ref) mm
STYLE 1												
No. 10	0.190	32	0.31	7.9	0.88	22.3	1.16	29.5	0.47	11.9	0.65	16.5
1/4	0.250	28	0.38	9.7	0.97	24.6	1.31	33.3	0.53	13.5	0.72	18.3
5/16	0.3125	24	0.44	11.2	1.12	28.4	1.56	39.6	0.59	15.0	0.81	20.6
3/8	0.375	24	0.56	14.2	1.38	35.0	1.81	46.0	0.81	20.6	1.03	26.2
7/16	0.4375	20	0.69	17.5	1.94	49.3	2.50	63.5	1.12	28.4	1.28	32.5
1/2	0.500	20	0.69	17.5	1.94	49.3	2.50	63.5	1.12	28.4	1.28	32.5
STYLE 2												
No. 10	0.190	32	—	—	0.88	22.3	1.06	26.9	0.47	11.9	0.65	16.5
1/4	0.250	28	—	—	0.97	24.6	1.22	31.0	0.50	12.7	0.72	18.3
5/16	0.3125	24	—	—	1.12	28.4	1.41	35.8	0.56	14.2	0.81	20.6
3/8	0.375	24	—	—	1.38	35.0	1.69	42.9	0.75	19.0	1.03	26.2
7/16	0.4375	20	—	—	1.94	49.3	2.38	60.5	1.00	25.4	1.28	32.5
1/2	0.500	20	—	—	1.94	49.3	2.38	60.5	1.00	25.4	1.28	32.5
5/8	0.625	18	—	—	2.06	52.3	2.58	65.5	1.00	25.4	1.47	37.3
3/4	0.750	16	—	—	2.12	53.8	3.00	76.2	1.12	28.4	1.59	40.4
STYLE 3(2)												
No. 10	0.190	32	—	—	0.88	22.3	1.16	29.5	0.47	11.9	0.65	16.5
1/4	0.250	28	—	—	0.97	24.6	1.31	33.3	0.53	13.5	0.72	18.3
5/16	0.3125	24	—	—	1.12	28.4	1.56	39.6	0.59	15.0	0.81	20.6
3/8	0.375	24	—	—	1.38	35.0	1.81	46.0	0.81	20.6	1.03	26.2
1/2	0.500	20	—	—	1.94	49.3	2.62	66.5	1.12	28.4	1.28	32.5
5/8	0.625	18	—	—	2.12	53.8	3.00	76.2	1.12	28.4	1.59	40.4
3/4	0.750	16	—	—	2.12	53.8	3.00	76.2	1.12	28.4	1.59	40.4
STYLE 4(3)												
No. 10	0.190	32	—	—	0.97	24.6	1.22	31.0	0.44	11.2	0.72	18.3
1/4	0.250	28	—	—	0.97	24.6	1.22	31.0	0.50	12.7	0.72	18.3
5/16	0.3125	24	—	—	1.12	28.4	1.41	35.8	0.56	14.2	0.81	20.6
3/8	0.375	24	—	—	1.38	35.0	1.69	42.9	0.75	19.0	1.03	26.2
7/16	0.4375	20	—	—	1.94	49.3	2.38	60.5	1.00	25.4	1.28	32.5
1/2	0.500	20	—	—	1.94	49.3	2.38	60.5	1.00	25.4	1.28	32.5
5/8	0.625	18	—	—	2.06	52.3	2.58	65.5	1.00	25.4	1.47	37.3

1. These dimensions are given for design purposes only and are not intended for inspection.
2. Type G Style 3 ball joints are furnished with ball studs and ball cavities (ball stud only on 5/8 and 3/4 in sizes) hardened to assure longer wear.
3. Type G, Style 4 ball joints in all sizes are furnished with both ball studs and ball sockets hardened to assure longer wear.