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The Engineering Society For Advancing Mobility Land Sea Air and Space®

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SAE J694 SEP88

Disc Wheel/Hub or Drum Interface Dimensions — Commercial Vehicles

SAE Recommended Practice
Revised September 1988

Submitted for Recognition as an American National Standard

The Engineering Society For Advancing Mobility Land Sea Air and Space®
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TRUCK AND BUS PRACTICE

SAE J694

Issued May 1955
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Superseding J694 MAY88

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DISC WHEEL/HUB OR DRUM INTERFACE DIMENSIONS - COMMERCIAL VEHICLES

1. PURPOSE:

This SAE Recommended Practice defines wheel mounting systems and documents, the dimensions and tolerances necessary to maintain serviceability, and interchangeability in the interface areas. To be consistent with ISO, it is divided into two sections (I & II). Section I is in concert with ISO 4107, describing mounting systems currently used internationally and nominated for, or included in, the international standards for bolt circle interfaces. Section II records information on current mounting systems also used in North America. Components of different mounting systems with common bolt patterns could be mis-assembled together and cause service problems. Therefore, it is important to note that each mounting system should be treated individually and their components not be intermixed.

2. SCOPE:

This SAE Recommended Practice contains dimensions and their tolerances concerning disc wheel to hub or drum interface areas for commercial vehicles and multi-purpose passenger vehicles. Stamped disc wheels for single applications and special or less common applications are not covered in this recommended practice.

3. REFERENCES:

A. SAE J393 - Nomenclature - Wheels, Hubs and Rims for Commercial Vehicles
B. ISO 4107 - Road Vehicles - Wheels for Commercial Vehicles - Dimensional Characteristics of Attachment on Hub
C. ISO 7575 - Road Vehicles - Wheels for Commercial Vehicles - Flat Attachment - Fixing Nuts

4. DEFINITIONS:

A detailed listing of basic nomenclature is contained in SAE J393. Figs. 1 through 13 introduce, illustrate, and specify additional nomenclature and definitions.

Mounting System: The combination of wheel/hub or drum interface characteristics that identify uniqueness. These characteristics are: number of bolt holes, bolt circle diameter and fastener type. Unique mounting systems are identified by the Roman numerals in applicable tables throughout the recommended practice. Within a given mounting system, the wheels are interchangeable only by use of the appropriate fasteners and/or hubs with appropriate dimensions for the wheel material shown.

5. SECTION I - DISC WHEELS/HUB OR DRUM INTERFACE FOR ISO COMPATIBLE WHEELS:

5.1 Wheel Dimensions:

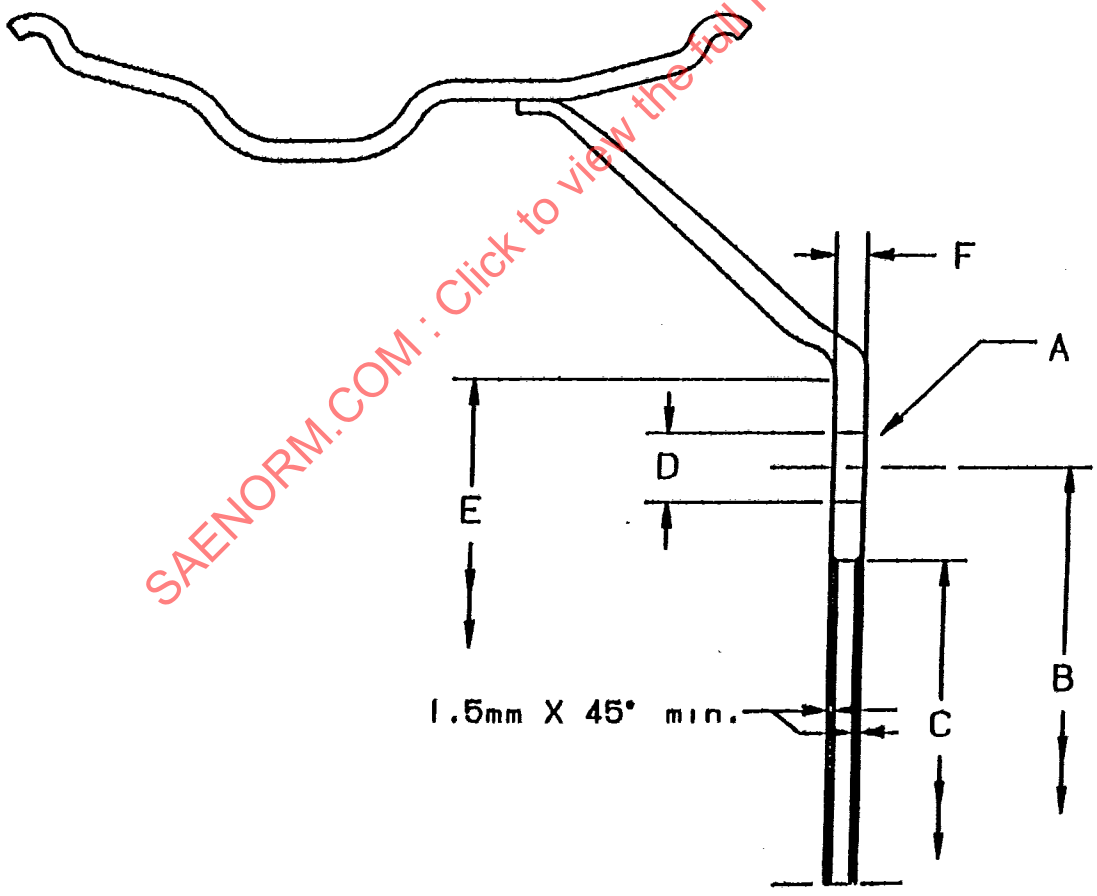

FIGURE 1 - Ferrous Disc Wheel

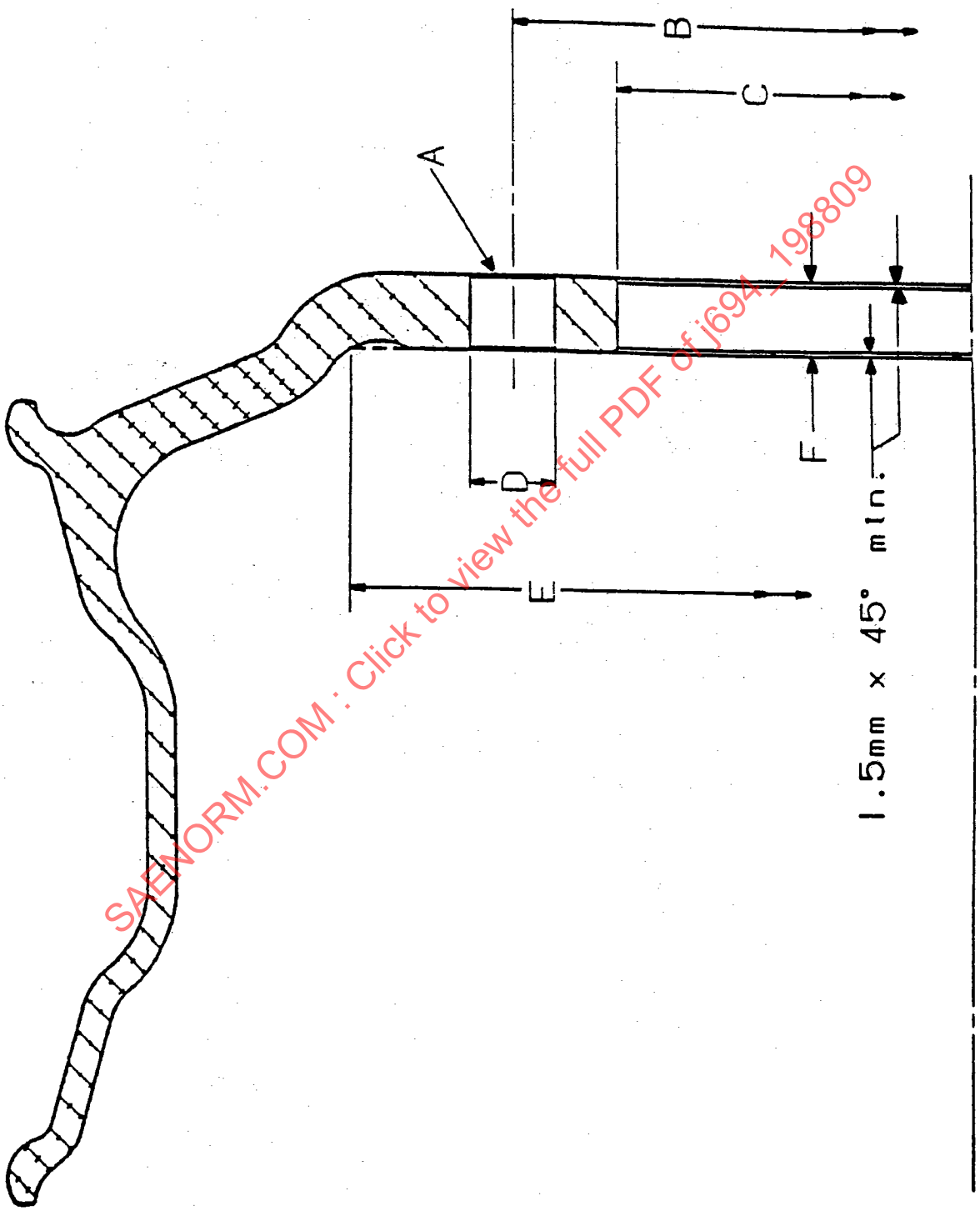

FIGURE 2 - Aluminum Disc Wheel

5.1.1 Definitions of Wheel Dimensions (Ref. Fig. 1 and 2):

A = number of bolt holes
B = bolt circle diameter
C = center hole diameter
D = bolt hole diameter
E = disc flat clearance diameter
F = disc thickness

5.1.2 Dimensions and Tolerances of Wheels:

5.1.2.1 Inch System Mountings (all dimensions in inches):

MOUNTING SYSTEMS FOR FERROUS & ALUMINUM WHEELS					DIMENSIONS			
Mounting System	A # of Bolt Holes	B ⌖ 0.010 Ø Bolt Circle Diameter	Fastener Type	Wheel Material	C Center Hole Diameter	D +0.09, -0 Bolt Hole Diameter	E Min Disc Flat Clearance Diameter	F Max Disc Thickness
I	8	6.500	FN[1]	Ferrous Aluminum	4.878/4.888 4.880/4.888	0.60 0.60	8.60 8.60	0.35 0.57

[1]FN - Flange nut

5.1.2.2 Metric System Mountings (all dimensions in mm):

MOUNTING SYSTEMS FOR FERROUS & ALUMINUM WHEELS					DIMENSIONS			
Mounting System	A # of Bolt Holes	B Ø 0.3 Ø Bolt Circle Diameter	Fastener Type (1)	Wheel Material (1)	C +0.2, -0 Center Hole Diameter	D +1, -0 Bolt Hole Diameter	E Min Disc Flat Clearance Diameter	F Max Disc Thickness (1)
II	8	275	FN	Ferrous Aluminum	221 221.1	24 24	325 325	13 25.4
III	10	285.75	FN	Ferrous Aluminum	220 220.1	26 26	345 345	14 25.4
IV	10	335	FN	Ferrous Aluminum	281 281.2	26 26	390 390	14 25.4

(1) Disc thickness, fastener type and aluminum disc wheels are not included in ISO Standard 4107.

5.2 Hub or Drum Interface Dimensions:

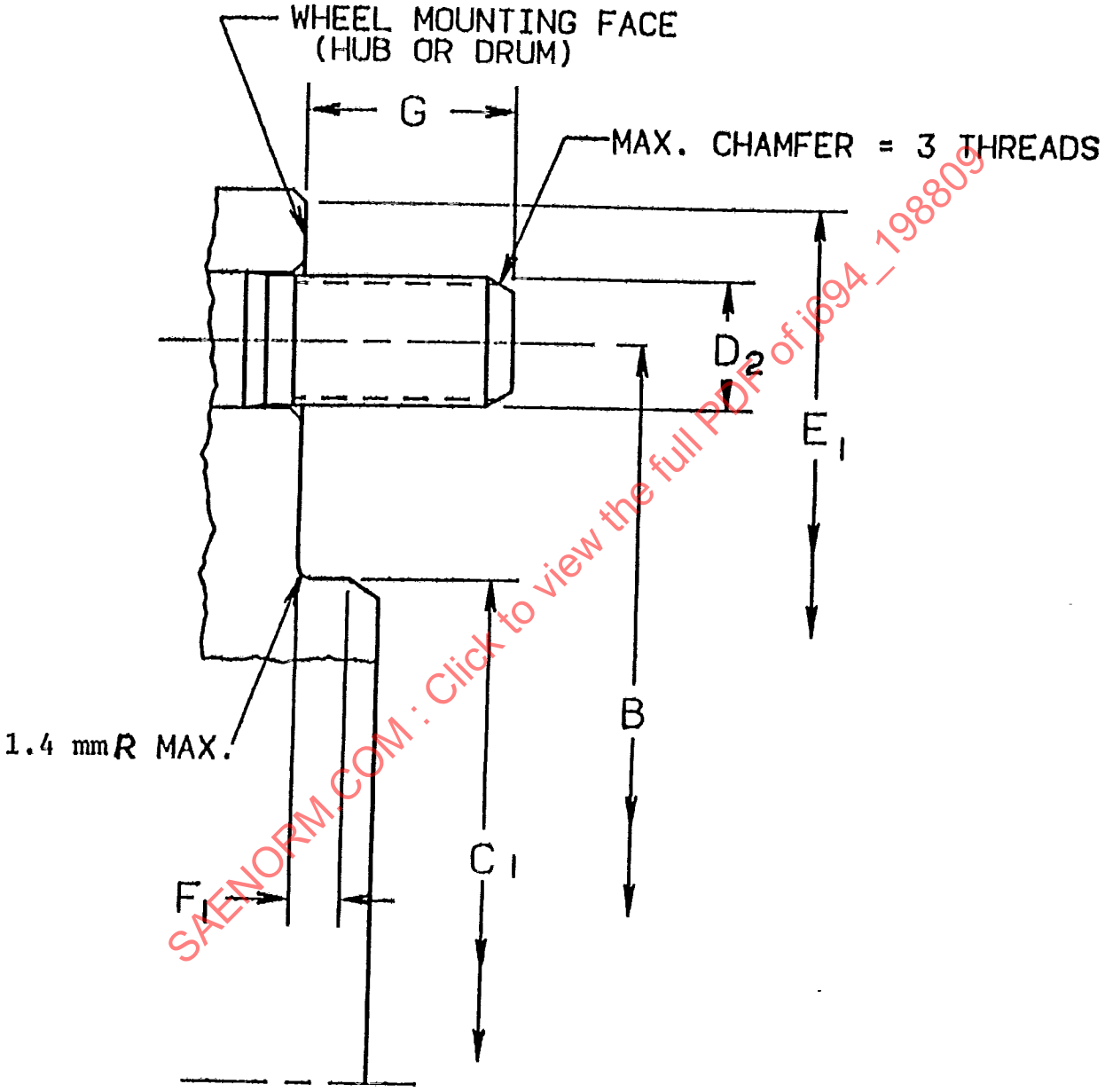

FIGURE 3 - Hub or Drum Interface Dimensions

5.2.1 Definitions of Hub or Drum Interface Dimensions (Ref. Fig. 3):

A = Number of studs or bolts
B = Bolt circle diameter
C1 = Wheel pilot diameter
D2 = Stud or bolt size
E1 = Diameter of wheel backup - Hub or outboard drum (usually not coincident with hub flange)
F1 = Pilot width (does not include lead in radius or chamfer)
G = Stud or bolt stand out beyond wheel mounting face of hub or outboard drum

5.2.2 Interface Dimensions and Tolerances of Hubs or Drums:

5.2.2.1 Inch System Mountings (all dimensions in inches):

MOUNTING SYSTEMS					DIMENSIONS						
		B						F1 (Min) Pilot Width		G Stand Out	
Mounting System	A # of Studs or Bolts	Ø 0.010 Ⓜ Bolt Circle Diameter	Fastener Type	Wheel Material	D2 Stud or Bolt Diameter	C1 Wheel Pilot Diameter	E1 Wheel Backup Diameter	Single	Dual	Single Min	Dual Min
I	8	6.500	FN	Ferrous	0.563	4.872/4.877	8.38/8.50	0.25	0.62	1.39	1.74
				Aluminum	0.563	4.872/4.877	8.38/8.50	0.25	0.81	1.61	2.18

5.2.2.2 Metric System Mountings (all dimensions in mm):

MOUNTING SYSTEMS				DIMENSIONS						
		B					F1 (Min) Pilot Width		G (Min) Stand Out	
Mounting System	A # of Studs or Bolts	Ø 0.3 Ø Bolt Circle Diameter	Fastener Type	D2 Stud or Bolt Diameter	C1 +0, -.2 Wheel Pilot Diameter	E1 Wheel Backup Diameter	Single	Dual	Single	Dual
II	8	275	FN (1) FN (2)	20 20	220.8 220.8	315/320 315/320	13 13	26 35	42 54	55 79
III	10	285.75	FN (1) FN (2)	22 22	219.8 219.8	335/340 335/340	13 13	26 35	48 59	62 84
IV	10	335	FN (1) FN (2)	22 22	280.8 280.8	380/385 380/385	13 13	26 35	48 59	62 84

(1) Ferrous wheels
(2) Aluminum or ferrous wheels

5.3 Fastener Dimensions & Tolerances:

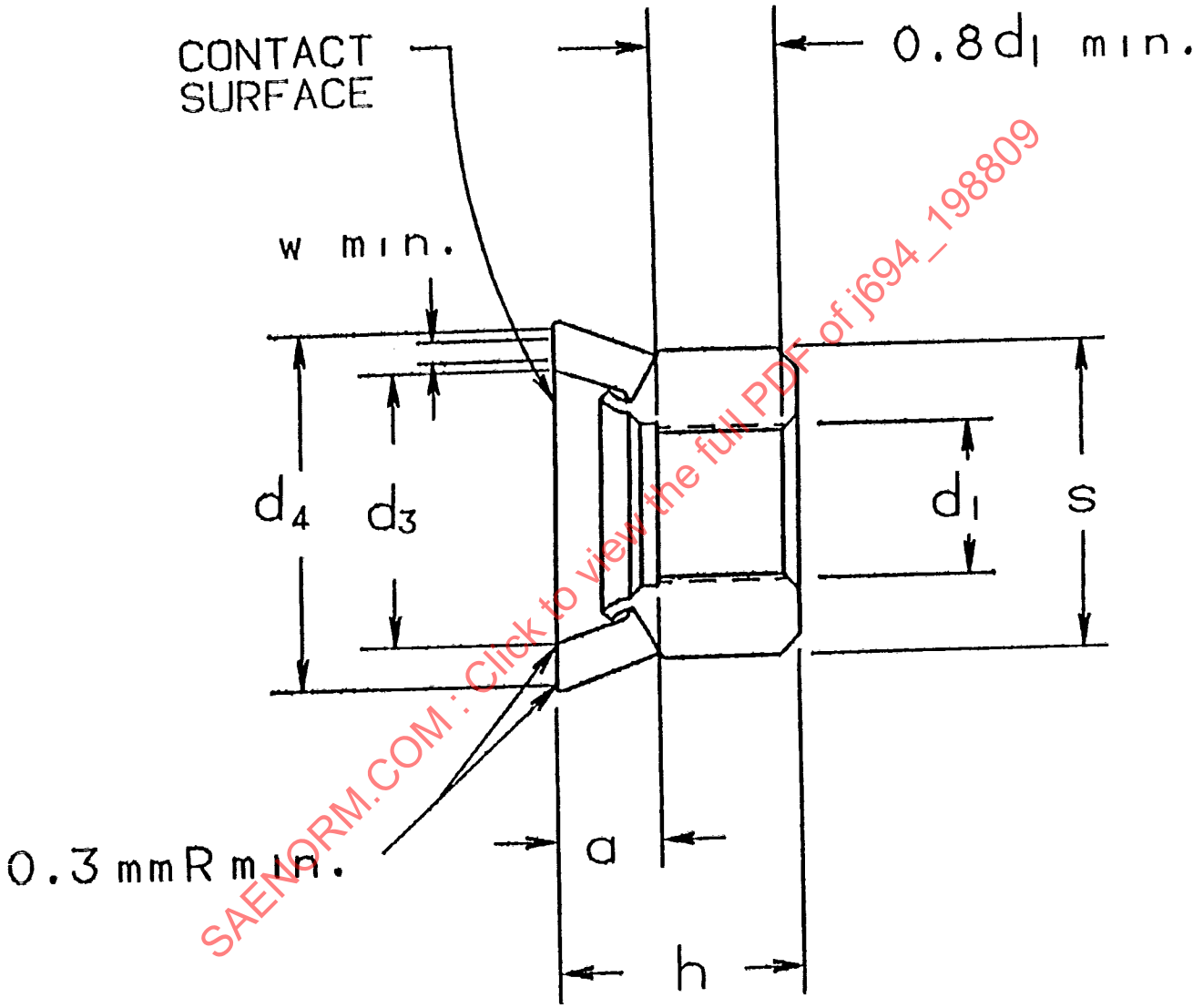

FIGURE 4 - Two Piece Flange Nut

5.3.1 Definitions of Fastener Dimensions (Ref. Fig. 4):

a = Distance to first thread from seat end
d1 = Thread size
s = Nominal width across flats
d3 = Flange inner diameter
d4 = Flange outer diameter
w = Width of flange contact
h = Overall nut height

5.3.2 Dimensions and Tolerances of Two Piece Flange Nuts (FN):

5.3.2.1 Inch System Mountings (all dimensions in inches):

d1 Thread Size	s Hex Size	d3 Min Flange Inner Dia	d4 Max Flange Outer Dia	a Min Thread Start	w Min Width of Flange Contact	h Max Height of Nut & Flange
9/16 - 18	1.062	1.00	1.625	0.180	0.110	1.04

5.3.2.2 Metric System Mountings (all dimensions in mm):

M20 x 1.5	30	26	45	4.5	5.5	29
M22 x 1.5	33	28	49	4.5	6.0	34

6. SECTION II - INFORMATION ON MOUNTING SYSTEMS ALSO USED IN NORTH AMERICA:

6.1 Wheel Dimensions:

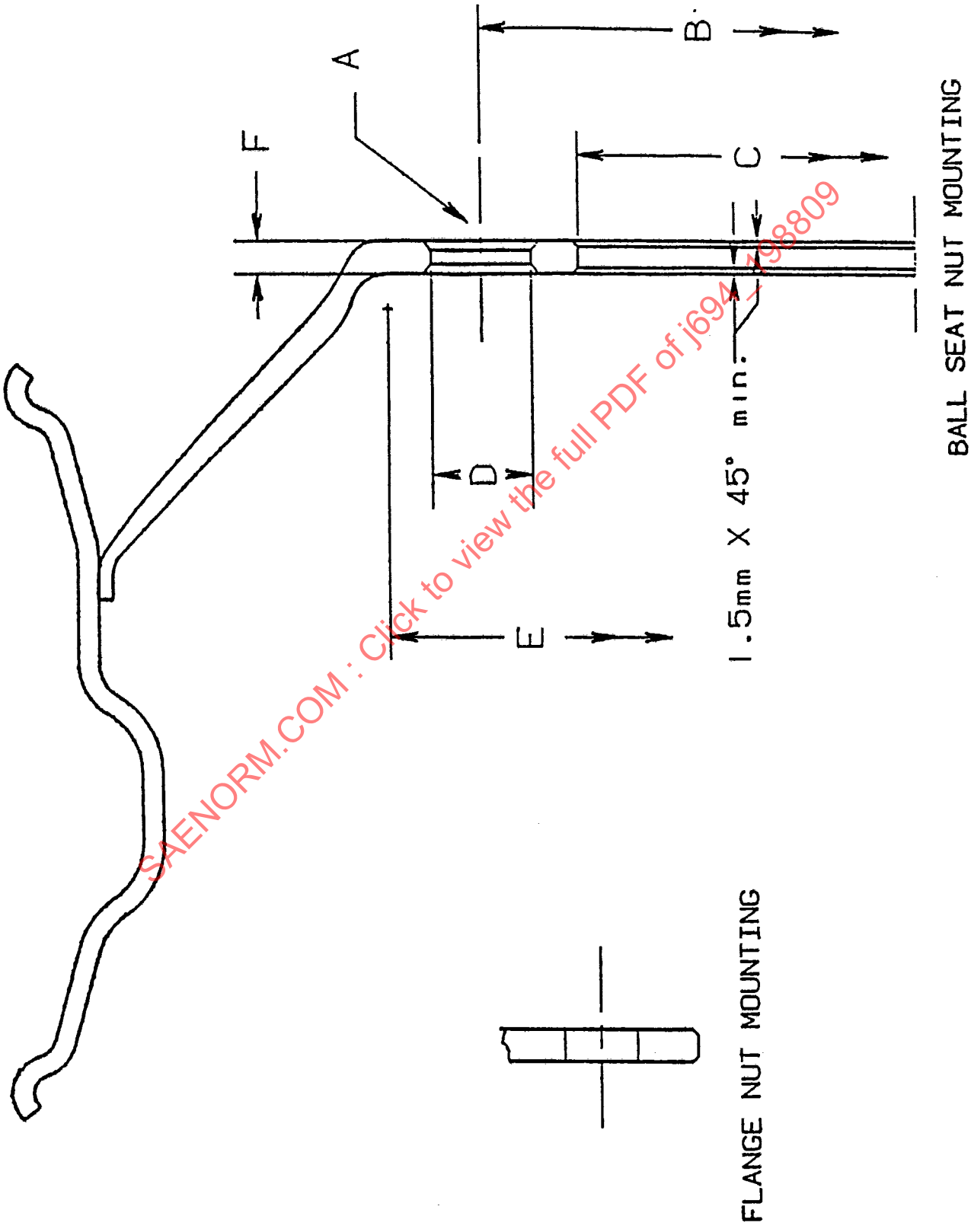

FIGURE 5 - Ferrous Disc Wheel

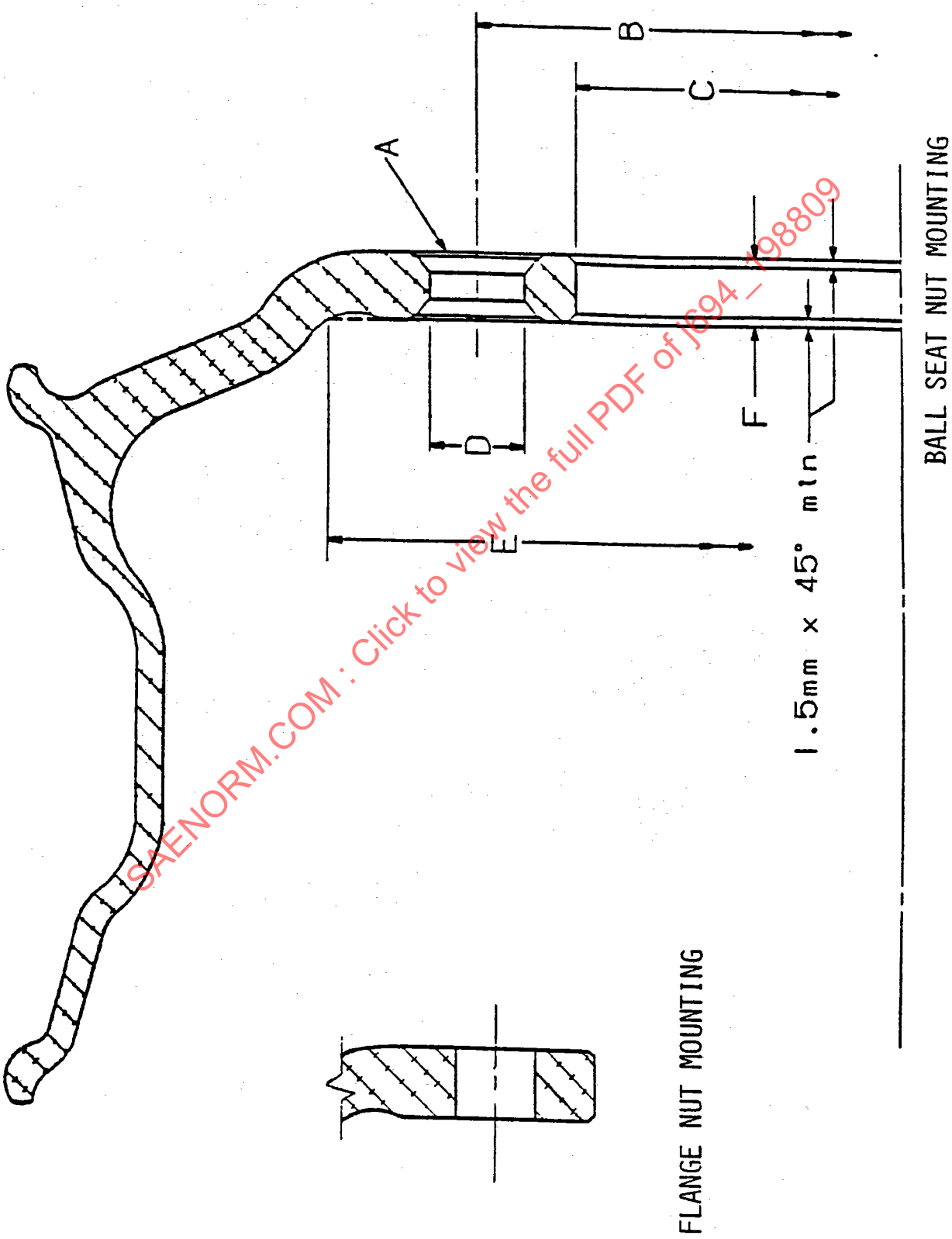

FIGURE 6 - Aluminum Disc Wheel

6.1.1 Definitions of Wheel Dimensions (Ref. Figs. 5 and 6):

A = number of bolt holes
B = bolt circle diameter
C = center hole diameter
D = bolt hole diameter
E = disc flat clearance diameter
F = disc thickness

6.1.2 Dimensions and Tolerances of Wheels:

6.1.2.1 Inch System Mountings (all dimensions in inches):

MOUNTING SYSTEMS FOR FERROUS & ALUMINUM WHEELS					DIMENSIONS			
Mounting System	A # of Bolt Holes	B Ø 0.010 Ⓜ Bolt Circle Diameter	Fastener Type	Wheel Material	C Center Hole Diameter	D +0.09, -0 Bolt Hole Diameter	E Min Disc Flat Clearance Diameter	F Max Disc Thickness
V	6	8.750	BSN	Ferrous	6.469 min	1.21	11.32	NA
			BSN-AL	Aluminum	6.495 min	1.18	11.32	NA
VI	8	6.500	FN	Ferrous	4.563/4.573	0.60 (1)	8.30	0.35
				Aluminum	4.565/4.573	0.60 (1)	8.30	0.57
VII	10	7.250	FN	Ferrous	5.251/5.254	0.64	9.23	0.35
				Aluminum	5.251/5.254	0.64	9.23	0.57
VIII	10	8.750	BSN	Ferrous	6.469 min	1.21	11.32	NA
IX	10	8.750	FN	Ferrous	6.251/6.259	1.10 (2)	11.32	0.50
X	10	11.250	BSN	Ferrous	8.725 min	1.21	13.56	NA
			BSN-AL	Aluminum	8.722 min	1.18	13.56	NA
XI	10	11.250	FN	Ferrous	8.665/8.673	1.18	13.56	0.50
				Aluminum	8.669/8.677	1.18	13.56	0.90
XII	10	13.188	BSN-heavy duty	Ferrous	10.650 min	1.35	15.48	NA

NOTE: Components of different mounting systems with common bolt patterns must not be intermixed

BSN - Ball seat nut
BSN-AL - Ball seat nut for aluminum wheels
FN - Flange nut
NA - Not applicable
(1) 0.75 for 0.625 diameter stud
(2) 1.00 for 0.688 diameter stud

6.1.2.2 Metric System Mountings (all dimensions in mm):

MOUNTING SYSTEMS FOR FERROUS AND ALUMINUM WHEELS						DIMENSIONS			
Mounting System	A # of Bolt Holes	B ⌀0.3 Ⓜ Bolt Circle Diameter	ISO STD. 4107	Fastener Type (1)	Wheel Material (1)	C +0.2, -0 Center Hole Diameter	D +1, -0 Bolt Hole Diameter	E Disc Flat Clearance Diameter	F Disc Thickness (1)
XIII	6	205	ISO	FN	Ferrous Aluminum	161 161.1	21 21	255 255	13 20
XIV	8	275		FN	Ferrous Aluminum	221 221.1	26 26	345 345	14 25.4

(1) Disc thickness, fastener type, and aluminum disc wheels are not included in ISO standard 4107.

6.2 Hub or Drum Interface Dimensions:

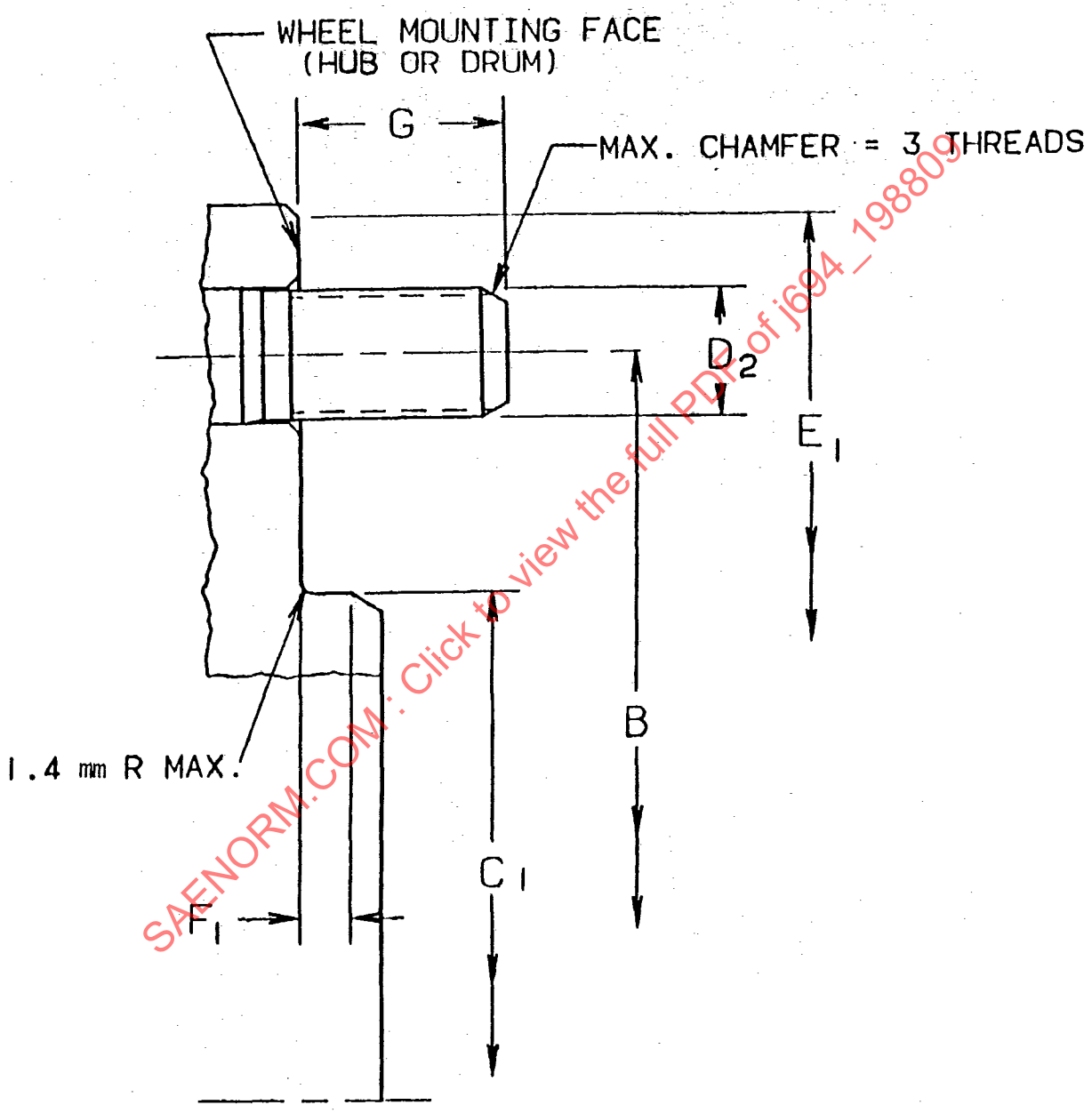

FIGURE 7 - Hub or Drum Interface Dimensions

6.2.1 Definitions of Hub or Drum Interface Dimensions (Ref. Fig. 7):

A = number of studs or bolts
B = bolt circle diameter
C1 = wheel pilot diameter
D2 = stud or bolt size
E1 = diameter of wheel backup - hub or outboard drum (usually not coincident with hub flange outside diameter)
F1 = pilot width (does not include lead in radius or chamfer)
G = stud or bolt standout beyond wheel mounting face of hub or outboard drum

6.2.2 Interface Dimensions and Tolerances of Hubs or Drums:

6.2.2.1 Inch System Mountings (all dimensions in inches):
Ø

MOUNTING SYSTEMS				DIMENSIONS						
MOUNTING SYSTEM	A # OF STUDS OR BOLTS	B Ⓜ 0.010 Ⓐ BOLT CIRCLE DIAMETER	FASTENER TYPE	D2 STUD OR BOLT DIAMETER	C1 WHEEL PILOT DIAMETER	E1 WHEEL BACKUP DIAMETER	F1 (MIN) PILOT WIDTH SINGLE	F1 (MIN) PILOT WIDTH DUAL	G STAND OUT SINGLE MIN	G STAND OUT DUAL
V	6	8.750	BSN	0.750 1.125	6.45 max	11.00/11.25	NA	NA	1.25	1.31/1.44
			BSN-AL	0.750 1.125	6.45 max	11.00/11.25	NA	NA	1.50	1.31/1.44
VI	8	6.500	FN (1)	0.563	4.554/4.562	8.00/8.25	0.25	0.62	1.44	1.79 min
			FN (2)	0.563	4.554/4.562	8.00/8.25	0.25	0.81	1.66	2.23 min
VII	10	7.250	FN (1)	0.625	5.245/5.250	9.00/9.13	0.24	0.62	1.44	1.79 min
			FN (2)	0.625	5.245/5.250	9.00/9.13	0.24	0.81	1.66	2.23 min
VIII	10	8.750	BSN	0.750 1.125	6.45 max	11.00/11.25	NA	NA	1.25	1.31/1.44
IX	10	8.750	FN (1)	0.688	6.242/6.250	11.00/11.25	0.34	0.81	1.59	2.09 min
X	10	11.250	BSN	0.750 1.125	8.720 max	13.18/13.50	NA	NA	1.25	1.31/1.44
			BSN-AL	0.750 1.125	8.720 max	13.18/13.50	NA	NA	1.60	1.31/1.44
XI	10	11.250	FN (1)	0.875	8.656/8.660	13.18/13.50	0.50	1.00	1.88	2.38 min
			FN (2)	0.875	8.656/8.660	13.18/13.50	0.50	1.31	2.28	3.18 min
XII	10	13.188	BSN-hvy duty	0.938 1.312 1.125	10.645 max	15.25/15.38	NA	NA	1.25	1.68/1.81

NOTE: Components of different mounting systems with common bolt hole patterns must not be intermixed.

(1) Ferrous Wheels
(2) Aluminum or Ferrous Wheels

6.2.2.2 Metric System Mountings (all dimensions in mm):

MOUNTING SYSTEMS				DIMENSIONS						
MOUNTING SYSTEM	A # OF STUDS OR BOLTS	B Ø0.3 Ⓜ BOLT CIRCLE DIAMETER	FASTENER TYPE	D2 STUD OR BOLT DIAMETER	C1 +0, -0.2 WHEEL PILOT DIAMETER	E1 WHEEL BACKUP DIAMETER	F1 (MIN) PILOT WIDTH		G (MIN) STAND OUT	
							SINGLE	DUAL	SINGLE	DUAL
XIII	6	205	FN (1)	18	160.8	245/250	13	26	40	53
			FN (2)	18	160.8	245/250	13	30	47	67
XIV	8	275	FN (1)	22	220.8	334/343	13	26	49	63
			FN (2)	22	220.8	334/343	13	35	60	85

(1) Ferrous wheels
(2) Aluminum or ferrous wheels

6.3 Fastener Types, Dimensions & Tolerances:

6.3.1 Definitions of Fastener Dimensions (Reference Figs. 8, 9, 10, 11, 12, 13):

a = Distance to first thread from seat end
b = Depth of inner thread from seat end
c = Distance of outer thread from seat end
d1 = Thread size
d2 = Outer thread size
e = Seat diameter
f = Shoulder length
s = Nominal width across flats
g = Shoulder diameter
d3 = Flange inner diameter
d4 = Flange outer diameter
r = Ball seat radius (must be appropriate to nut seat of wheel)
w = Width of flange contact
h = Overall nut height
x = Ball seat or cone intersection reference diameter

6.3.2 Dimensions and Tolerances of Ball Seat Nuts (BSN) for Inch System Mountings (all dimensions in inches):

6.3.2.1 Single or Outer Ball Seat Nut for Ferrous Wheels (BSN):

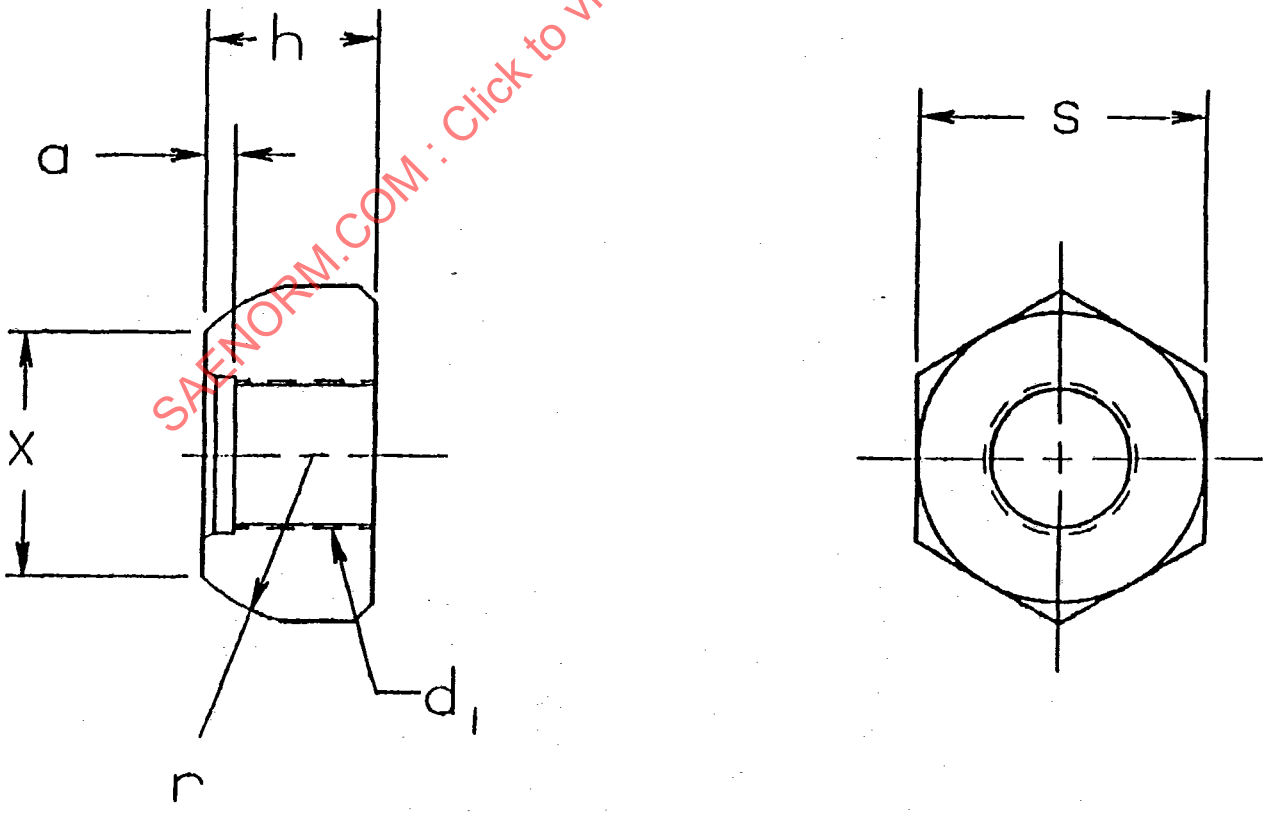

FIGURE 8 - Single or Outer Dual Ball Seat Nut for Ferrous Wheels

6.3.2.1 (Continued):

d1 Thread Size	s Hex Size	r ±0.010 Ball Seat Radius	a Min Thread Start	h Max Overall Nut Height	x (Ref) Intersection Diameter	Disc Thickness
3/4 - 16	1.50	0.875	0.25	0.91	1.25	0.625 or less
1-1/8 - 16	1.50	0.875	0.06	0.91	1.25	All
15/16 - 12(1)	1.75	1.188	0.12	1.41	1.469	All
1-5/16 - 12(1)	1.75	1.188	0.12	1.41	1.469	All

(1) BSN-heavy duty

6.3.2.2 Inner Dual Ball Seat Nut for Ferrous Wheels (BSN):

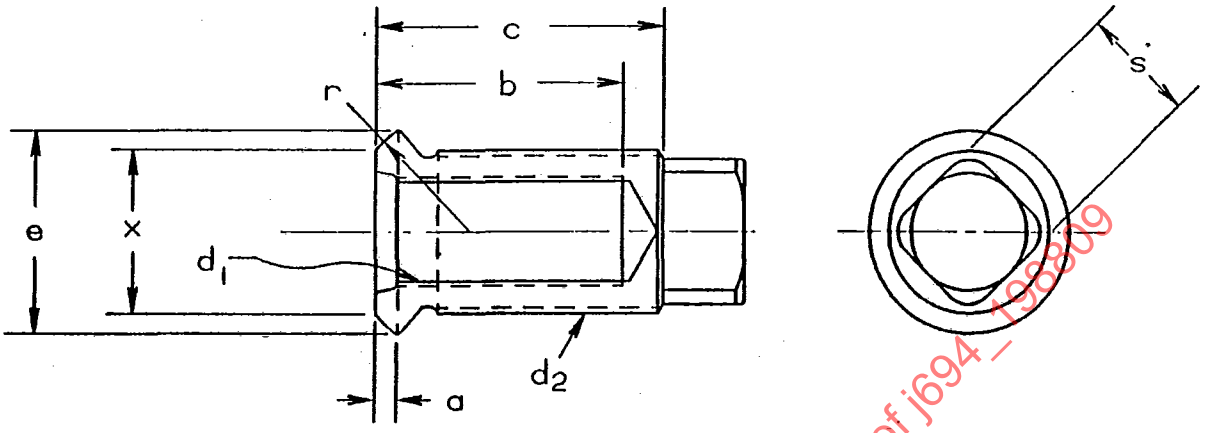

FIGURE 9 - Inner Dual Ball Seat Nut for Ferrous Wheels

d1 Inner Thread	d2 Outer Thread	s Wrench Flat	r ±0.010 Ball Seat Radius	a Min Thread Start	b Min Thread Length	c Min Thread Length	e Seat Dia	x (Ref) Intersec. Diameter	Disc Thickness
3/4 - 16	1-1/8 - 16	0.813	0.875	0.250	1.25	1.375	1.425 1.385	1.195	0.625 max
15/16 - 12 (1)	1-5/16 - 12	0.938	1.188	0.250	1.88	2.000	1.693 1.677	1.344	All

(1) BSN-heavy duty

6.3.2.3 Single or Outer Dual Ball Seat Nut for Aluminum Wheels (BSN-AL):

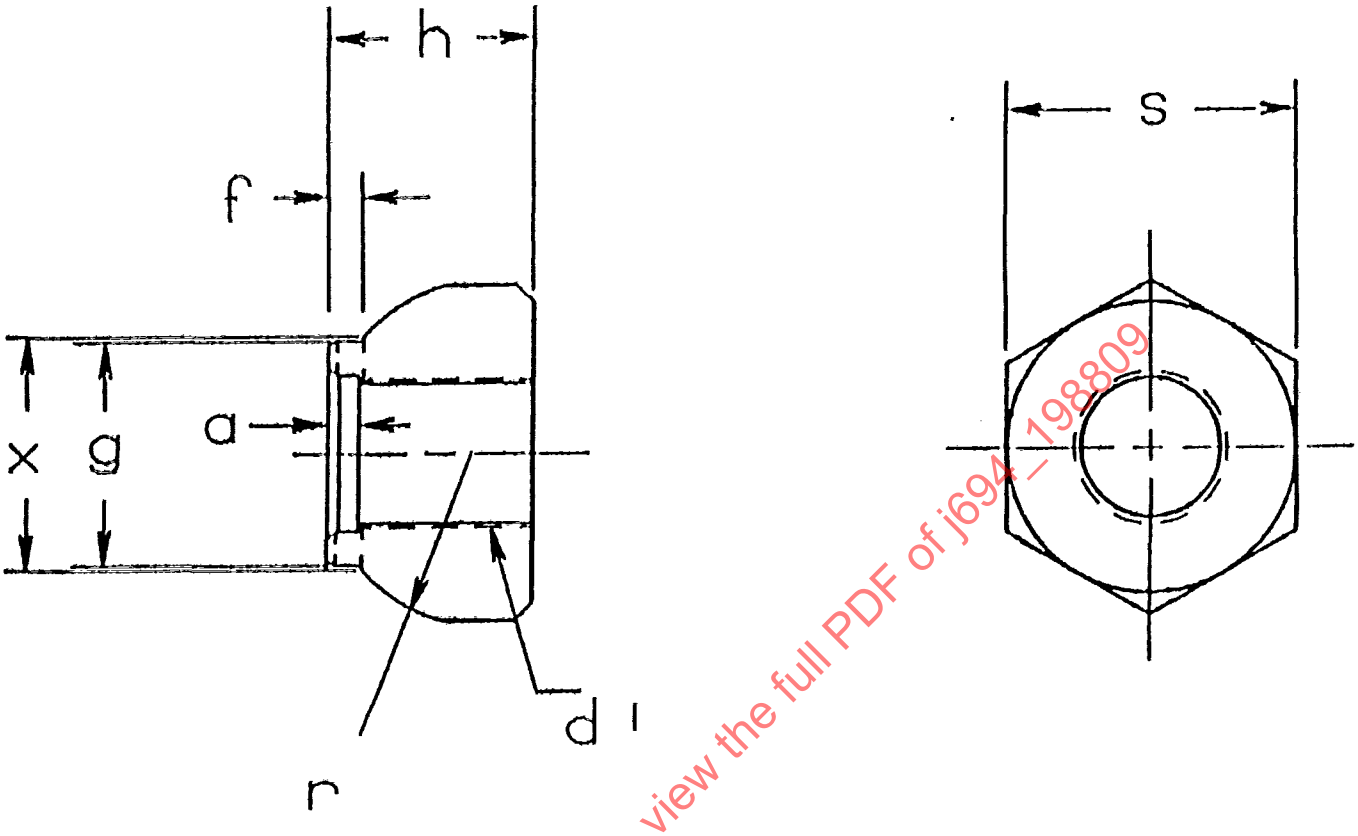

FIGURE 10 - Single or Outer Dual Ball Seat Nut for Aluminum Wheels

d1 Thread Size	s Hex Size	r ±0.010 Ball Seat Radius	a Min Thread Start	f +0.10, -0 Shoulder Length	g Max Shoulder Diameter	h (Max) Overall Nut Height	x (Ref) Intersec. Diameter	Disc Thickness
3/4 - 16	1.50	0.875	0.170	0.18	1.14	1.10	1.187	Greater than 0.625
1-1/8 - 16	Same as ball seat nut for ferrous wheels, Ref: 6.3.2.1							