BEML LIMITED

(A Govt. of India Mini Rathna Company under Ministry of Defence)
BEML Soudha, 23/1, 4th Main Road, SR Nagar, Bangalore 560 027.
Phone 080-22963179 email: tirthabharati.samal@bemlltd.in

EOI Ref: BEML/CMRM/ROUND & BAR Date: 09/10/2024

EOI (Expression of Interest) is invited from steel suppliers for the items as shown at table below:-

Sl No.	Stock No.	FAMILY	GRADE/Nearest grade (normalised condition)	DIA	CUT/ SUPPLY LENGTH	Unit	Qty
				MM	MM		(approx.)
1	460TMB0098	ROUND	16Mn5Cr4; IS4432	36	Std 5~7 Mtr	Kg	9387
2	701ZZB0017	ROUND	709M40	32	Std 5~7 Mtr	Kg	438
3	701ZZB0025	ROUND	709M40	36	Std 5~7 Mtr	Kg	141
4	701ZZB0033	ROUND	709M40	75	Std 5~7 Mtr	Kg	420
5	11Z9910024	ROUND	AISI/KC1085- sph. anneal	60	Std 5~7 Mtr	No	98
6	30Z9910117	ROUND	AISI/KC1085- sph. anneal	70	Std 5~7 Mtr	No	145
7	41Z9900026	ROUND	AISI/KC1085- sph. anneal	70	Std 5~7 Mtr	No	80
8	51Z9910212	ROUND	AISI/KC1085- sph. anneal	80	Std 5~7 Mtr	No	199
9	225RSB9768	ROUND	AISI420 (En 56B)	56	Std 5~7 Mtr	Kg	90797
10	C100108006	ROUND	C1001-08 IS2062 gr B	6	Std 5~7 Mtr	Kg	103
11	C100108008	ROUND	C1001-08	8	Std 5~7 Mtr	Kg	104
12	C100108010	ROUND	C1001-08	10	Std 5~7 Mtr	Kg	355
13	C100108012	ROUND	C1001-08	12	Std 5~7 Mtr	Kg	678
14	C100108016	ROUND	C1001-08	16	Std 5~7 Mtr	Kg	383
15	C100108020	ROUND	C1001-08	20	Std 5~7 Mtr	Kg	218
16	C100108022	ROUND	C1001-08	22	Std 5~7 Mtr	Kg	26
17	C100108025	ROUND	C1001-08	25	Std 5~7 Mtr	Kg	846
18	C100108028	ROUND	C1001-08	28	Std 5~7 Mtr	Kg	13
19	C100108032	ROUND	C1001-08	32	Std 5~7 Mtr	Kg	199
20	C100108036	ROUND	C1001-08	36	Std 5~7 Mtr	Kg	117
21	C100108040	ROUND	C1001-08	40	Std 5~7 Mtr	Kg	275
22	C100108045	ROUND	C1001-08	45	Std 5~7 Mtr	Kg	262
23	C100108050	ROUND	C1001-08	50	7250	Kg	4630
24	C100108056	ROUND	C1001-08	56	Std 5~7 Mtr	Kg	45
25	C100108063	ROUND	C1001-08	63	Std 5~7 Mtr	Kg	196
26	C100108070	ROUND	C1001-08	70	Std 5~7 Mtr	Kg	1900
27	C100108075	ROUND	C1001-08	75	Std 5~7 Mtr	Kg	4130
28	C100108080	ROUND	C1001-08	80	Std 5~7 Mtr	Kg	721
29	C100108085	ROUND	C1001-08	85	Std 5~7 Mtr	Kg	15
30	C100108090	ROUND	C1001-08	90	Std 5~7 Mtr	Kg	662
31	C100108100	ROUND	C1001-08	100	Std 5~7 Mtr	Kg	1072
32	C100108110	ROUND	C1001-08	110	Std 5~7 Mtr	Kg	1629
33	C100108120	ROUND	C1001-08	120	Std 5~7 Mtr	Kg	1358
34	C100108160	ROUND	C1001-08	160	Std 5~7 Mtr	Kg	1793
35	C100109120	ROUND	C1001-09	120	Std 5~7 Mtr	Kg	178
36	C100109140	ROUND	C1001-09	140	Std 5~7 Mtr	Kg	4130
37	C100109150	ROUND	C1001-09	150	Std 5~7 Mtr	Kg	2142
38	C100109160	ROUND	C1001-09	160	Std 5~7 Mtr	Kg	2999
39	C100109175	ROUND	C1001-09	175	Std 5~7 Mtr	Kg	355
40	C100109200	ROUND	C1001-09	200	Std 5~7 Mtr	Kg	576
41	C100111012	SQUARE	C1001-11	12	Std 5~7 Mtr	Kg	7858
42	C100111016	SQUARE	C1001-11	16	Std 5~7 Mtr	Kg	73
43	C100111020	SQUARE	C1001-11	20	Std 5~7 Mtr	Kg	92
44	C100111025	SQUARE	C1001-11	25	Std 5~7 Mtr	Kg	75
45	C100111032	SQUARE	C1001-11	32	Std 5~7 Mtr	Kg	271
46	C100111040	SQUARE	C1001-11	40	Std 5~7 Mtr	Kg	844

47	C100111050	SQUARE	C1001-11	50	Std 5~7 Mtr	Kg	5679
48	C100111063	SQUARE	C1001-11	63	1580	Kg	1446
49	C100111100	SQUARE	C1001-11	100	Std 5~7 Mtr	Kg	3020
50	C100288009	SQUARE	C1002-88/ IS2062E410C	100X100	3500	Kg	109
51	C100288010	SQUARE	C1002-88	100X100	4200	Kg	103
52	2AR056004500	ROUND	C1101	56	4500	Kg	6447
53	2AR070004100	ROUND	C1101	70	4100	Kg	4104
54	2AR070004700	ROUND	C1101	70	4700	Kg	1271
55	2AR080005300	ROUND	C1101	80	5300	Kg	12275
56	2AR100005400	ROUND	C1101	100	5400	Kg	20406
57	C110108008	ROUND	C1101-08 /CK45	8	Std 5~7 Mtr	Kg	20
58	C110108012	ROUND	C1101-08	12	Std 5~7 Mtr	Kg	21
59	C110108016	ROUND	C1101-08	16	Std 5~7 Mtr	Kg	455
60	C110108018	ROUND	C1101-08	18	Std 5~7 Mtr	Kg	764
61	C110108020	ROUND	C1101-08	20	Std 5~7 Mtr	Kg	33
62	C110108025	ROUND	C1101-08	25	Std 5~7 Mtr	Kg	910
63	C110108032	ROUND	C1101-08	32	Std 5~7 Mtr	Kg	239
64	C110108036	ROUND	C1101-08	36	Std 5~7 Mtr	Kg	971
65	C110108040	ROUND	C1101-08	40	Std 5~7 Mtr	Kg	6737
66	C110108045	ROUND	C1101-08	45	Std 5~7 Mtr	Kg	3201
67	C110108050	ROUND	C1101-08	50	Std 5~7 Mtr	Kg	715
68	C110108056	ROUND	C1101-08	56	Std 5~7 Mtr	Kg	6301
69	C110108060	ROUND	C1101-08	60	Std 5~7 Mtr	Kg	38
70	C110108063	ROUND	C1101-08	63	Std 5~7 Mtr	Kg	3930
71	C110108070	ROUND	C1101-08	70	Std 5~7 Mtr	Kg	5751
72	C110108075	ROUND	C1101-08	75	Std 5~7 Mtr	Kg	1243
73	C110108080	ROUND	C1101-08	80	Std 5~7 Mtr	Kg	14162
74	C110108085	ROUND	C1101-08	85	Std 5~7 Mtr	Kg	19752
75	C110108090	ROUND	C1101-08	90	Std 5~7 Mtr	Kg	2529
76	C110108100	ROUND	C1101-08	100	Std 5~7 Mtr	Kg	19550
77	C110108110	ROUND	C1101-08	110	Std 5~7 Mtr	Kg	998
78	C110108120	ROUND	C1101-08	120	Std 5~7 Mtr	Kg	4089
79	C110108140	ROUND	C1101-08	140	Std 5~7 Mtr	Kg	170
80	C110109125	ROUND	C1101-09	125	Std 5~7 Mtr	Kg	2554
81	C110109140	ROUND	C1101-09	140	Std 5~7 Mtr	Kg	2024
82	C110109150	ROUND	C1101-09	150	Std 5~7 Mtr	Kg	2069
83	C110109160	ROUND	C1101-09	160	Std 5~7 Mtr	Kg	875
84	C110109170	ROUND	C1101-09	170	Std 5~7 Mtr	Kg	2451
85	C110109180	ROUND	C1101-09	180	Std 5~7 Mtr	Kg	673
86	C110109200	ROUND	C1101-09	200	Std 5~7 Mtr	Kg	2983
87	C110109210	ROUND	C1101-09	210	Std 5~7 Mtr	Kg	2612
88	C110109240	ROUND	C1101-09	240	Std 5~7 Mtr	Kg	3069
89	C110109270	ROUND	C1101-09	270	Std 5~7 Mtr	Kg	4829
90	C110111020	SQUARE	C1101-11	20	Std 5~7 Mtr	Kg	9
91	C120408025	ROUND	C1204-08/SAE8620H	25	Std 5~7 Mtr	Kg	179
92	C120408028	ROUND	C1204-08	28	Std 5~7 Mtr	Kg	14
93	C120408032	ROUND	C1204-08	32	Std 5~7 Mtr	Kg	37
94	C120408036	ROUND	C1204-08	36	Std 5~7 Mtr	Kg	142
95	C120408040	ROUND	C1204-08	40	Std 5~7 Mtr	Kg	214
96	C120408045	ROUND	C1204-08	45	Std 5~7 Mtr	Kg	4304
97	C120408056	ROUND	C1204-08	56	Std 5~7 Mtr	Kg	405
98	C120408063	ROUND	C1204-08	63	Std 5~7 Mtr	Kg	1474
99	C120408070	ROUND	C1204-08	70	Std 5~7 Mtr	Kg	234
100	C120408080	ROUND	C1204-08	80	Std 5~7 Mtr	Kg	185
101	C120408090	ROUND	C1204-08	90	Std 5~7 Mtr	Kg	586
102	C120408100	ROUND	C1204-08	100	Std 5~7 Mtr	Kg	253
103	C120408120	ROUND	C1204-08	120	Std 5~7 Mtr	Kg	70
104	C120408125	ROUND	C1204-08	125	Std 5~7 Mtr	Kg	1147

105	C120409125	ROUND	C1204-09	125	Std 5~7 Mtr	Kg	178
106	C120409140	ROUND	C1204-09	140	Std 5~7 Mtr	Kg	254
107	C120409150	ROUND	C1204-09	150	Std 5~7 Mtr	Kg	41
108	C120409160	ROUND	C1204-09	160	Std 5~7 Mtr	Kg	163
109	C120508016	ROUND	C1205-08/SAE4320H	16	Std 5~7 Mtr	Kg	82
110	C120508032	ROUND	C1205-08	32	Std 5~7 Mtr	Kg	21
111	C120508045	ROUND	C1205-08	45	Std 5~7 Mtr	Kg	166
112	C120508050	ROUND	C1205-08	50	Std 5~7 Mtr	Kg	1115
113	C120508056	ROUND	C1205-08	56	Std 5~7 Mtr	Kg	4957
114	C120508060	ROUND	C1205-08	60	Std 5~7 Mtr	Kg	1561
115	C120508063	ROUND	C1205-08	63	Std 5~7 Mtr	Kg	2566
116	C120508080	ROUND	C1205-08	80	Std 5~7 Mtr	Kg	556
117	C120508090	ROUND	C1205-08	90	Std 5~7 Mtr	Kg	5894
118	C120508100	ROUND	C1205-08	100	Std 5~7 Mtr	Kg	1693
119	C120508125	ROUND	C1205-08	125	Std 5~7 Mtr	Kg	73
120	C120509110	ROUND	C1205-09	110	Std 5~7 Mtr	Kg	995
121	C120509120	ROUND	C1205-09	120	Std 5~7 Mtr	Kg	245
122	C120509125	ROUND	C1205-09	125	Std 5~7 Mtr	Kg	4271
123	C120509140	ROUND	C1205-09	140	Std 5~7 Mtr	Kg	1349
124	C120509150	ROUND	C1205-09	150	Std 5~7 Mtr	Kg	496
125	C120509160	ROUND	C1205-09	160	Std 5~7 Mtr	Kg	2825
126	C120509170	ROUND	C1205-09	170	Std 5~7 Mtr	Kg	433
127	C120509180	ROUND	C1205-09	180	Std 5~7 Mtr	Kg	1944
128	C120509200	ROUND	C1205-09	200	Std 5~7 Mtr	Kg	2209
129	C120509240	ROUND	C1205-09	240	Std 5~7 Mtr	Kg	912
130	C120509260	ROUND	C1205-09	260	Std 5~7 Mtr	Kg	450
131	C120509270	ROUND	C1205-09	270	Std 5~7 Mtr	Kg	340
132	C120509290	ROUND	C1205-09	290	Std 5~7 Mtr	Kg	526
133	2CR100004700	ROUND	C1209/SAE4135H	0.1	4700	Kg	9944
134	2CR056001775	ROUND	C1209	56	1775	Kg	8340
135	2CR056001970	ROUND	C1209	56	1970	Kg	6263
136	2CR063002300	ROUND	C1209	63	2300	Kg	2972
137	2CR110004000	ROUND	C1209	110	4000	Kg	9543
138	2CR120004200	ROUND	C1209	120	4200	Kg	2610
139	2CR125004600	ROUND	C1209	125	4600	Kg	1139
140	2CR140001990	ROUND	C1209	140	1990	Kg	721
141	2CR140002255	ROUND	C1209	140	2255	Kg	2044
142	181HCB9385	ROUND	C1209	150	2700	Kg	2301
143	2CR150002375	ROUND	C1209	150	2375	Kg	2672
144	2CR150002740	ROUND	C1209	150	2740	Kg	2281
145	181HCB9239	ROUND	C1209	170	2610	Kg	3886
146	181HCB9247	ROUND	C1209	170	2540	Kg	2187
147	181HCB9369	ROUND	C1209	170	2645	Kg	1791
148	2CR170002160	ROUND	C1209	170	2160	Kg	9728
149	2CR170002375	ROUND	C1209	170	2375	Kg	2327
150	2CR170002730	ROUND	C1209	170	2730	Kg	13439
151	2CR180002615	ROUND	C1209	180	2615	Kg	10960
152	181HCB9296	ROUND	C1209	200	3250	Kg	3358
153	C120908025	ROUND	C1209-08	25	Std 5~7 Mtr	Kg	163
154	C120908030	ROUND	C1209-08	30	Std 5~7 Mtr	Kg	13251
155	C120908040	ROUND	C1209-08	40	Std 5~7 Mtr	Kg	941
156	C120908045	ROUND	C1209-08	45	Std 5~7 Mtr	Kg	0
157	C120908050	ROUND	C1209-08	50	Std 5~7 Mtr	Kg	2334
158	C120908056	ROUND	C1209-08	56	Std 5~7 Mtr	Kg	9807
159	C120908063	ROUND	C1209-08	63	Std 5~7 Mtr	Kg	34488
160	C120908070	ROUND	C1209-08	70	Std 5~7 Mtr	Kg	16573
161	C120908075	ROUND	C1209-08	75	Std 5~7 Mtr	Kg	2176
162	C120908080	ROUND	C1209-08	80	Std 5~7 Mtr	Kg	17465

163	C120908085	ROUND	C1209-08	85	Std 5~7 Mtr	Kg	5217
164	C120908090	ROUND	C1209-08	90	Std 5~7 Mtr	Kg	25575
165	C120908100	ROUND	C1209-08	100	Std 5~7 Mtr	Kg	43508
166	C120908110	ROUND	C1209-08	110	Std 5~7 Mtr	Kg	13077
167	C120908120	ROUND	C1209-08	120	Std 5~7 Mtr	Kg	28022
168	C120908125	ROUND	C1209-08	125	Std 5~7 Mtr	Kg	3732
169	C120908130	ROUND	C1209-08	130	Std 5~7 Mtr	Kg	1860
170	C120908140	ROUND	C1209-08	140	Std 5~7 Mtr	Kg	588
171	C120908150	ROUND	C1209-08	150	Std 5~7 Mtr	Kg	1188
172	C120908170	ROUND	C1209-08	170	Std 5~7 Mtr	Kg	600
173	C120909125	ROUND	C1209-09	125	Std 5~7 Mtr	Kg	989
174	C120909130	ROUND	C1209-09	130	Std 5~7 Mtr	Kg	481
175	C120909140	ROUND	C1209-09	140	Std 5~7 Mtr	Kg	18635
176	C120909150	ROUND	C1209-09	150	Std 5~7 Mtr	Kg	23539
177	C120909170	ROUND	C1209-09	170	Std 5~7 Mtr	Kg	14094
178	C120909180	ROUND	C1209-09	180	Std 5~7 Mtr	Kg	5083
179	C120909200	ROUND	C1209-09	200	2880	Kg	11576
180	C120909260	ROUND	C1209-09	260	Std 5~7 Mtr	Kg	842
181	C121008045	ROUND	C1210-08 / SAE4340H	45	Std 5~7 Mtr	Kg	282
182	C121008063	ROUND	C1210-08	63	Std 5~7 Mtr	Kg	412
183	C121008065	ROUND	C1210-08	65	Std 5~7 Mtr	Kg	105
184	C121008080	ROUND	C1210-08	80	Std 5~7 Mtr	Kg	211
185	C121008090	ROUND	C1210-08	90	Std 5~7 Mtr	Kg	22
186	C121008120	ROUND	C1210-08	120	Std 5~7 Mtr	Kg	146
187	C121008200	ROUND	C1210-08	200	Std 5~7 Mtr	Kg	123
188	C121009090	ROUND	C1210-09	90	Std 5~7 Mtr	Kg	14
189	C121009140	ROUND	C1210-09	140	Std 5~7 Mtr	Kg	138
190	C121009160	ROUND	C1210-09	160	Std 5~7 Mtr	Kg	280
191	C121009180	ROUND	C1210-09	180	Std 5~7 Mtr	Kg	664
192	C121009240	ROUND	C1210-09	240	Std 5~7 Mtr	Kg	71
193	C121009310	ROUND	C1210-09	310	Std 5~7 Mtr	Kg	271
194	C121209100	ROUND	C1212~09/SAE4140H	100	Std 5~7 Mtr	Kg	926
195	C121209110	ROUND	C1212~09	110	Std 5~7 Mtr	Kg	558
196	C121209125	ROUND	C1212~09	125	Std 5~7 Mtr	Kg	1556
197	C121209140	ROUND	C1212~09	140	Std 5~7 Mtr	Kg	2182
198	C121209150	ROUND	C1212~09	150	Std 5~7 Mtr	Kg	366
199	C121209160	ROUND	C1212~09	160	Std 5~7 Mtr	Kg	20
200	C121209170	ROUND	C1212~09	170	Std 5~7 Mtr	Kg	238
201	C121209180	ROUND	C1212~09	180	Std 5~7 Mtr	Kg	2362
202	C121209200	ROUND	C1212~09	200	Std 5~7 Mtr	Kg	469
203	C121209210	ROUND	C1212~09	210	Std 5~7 Mtr	Kg	136
204	C121208032	ROUND	C1212-08	32	Std 5~7 Mtr	Kg	2
205	C121208045	ROUND	C1212-08	45	Std 5~7 Mtr	Kg	964
206	C121208050	ROUND	C1212-08	50	Std 5~7 Mtr	Kg	303
207	C121208056	ROUND	C1212-08	56	Std 5~7 Mtr	Kg	330
208	C121208063	ROUND	C1212-08	63	Std 5~7 Mtr	Kg	2693
209	C121208070	ROUND	C1212-08	70	Std 5~7 Mtr	Kg	1450
210	C121208075	ROUND	C1212-08	75	Std 5~7 Mtr	Kg	726
211	C121208080	ROUND	C1212-08	80	Std 5~7 Mtr	Kg	1831
212	C121208090	ROUND	C1212-08	90	Std 5~7 Mtr	Kg	1122
213	C121208100	ROUND	C1212-08	100	Std 5~7 Mtr	Kg	2522
214	C121508036	ROUND	C1215-08/SAE4142RH	36	Std 5~7 Mtr	Kg	16
215	C121508042	ROUND	C1215-08	42	Std 5~7 Mtr	Kg	19435
216	C121508050	ROUND	C1215-08	50	Std 5~7 Mtr	Kg	28067
217	C121508052	ROUND	C1215-08	52	Std 5~7 Mtr	Kg	66724
218	C121508060	ROUND	C1215-08	60	Std 5~7 Mtr	Kg	101612
219	C121508075	ROUND	C1215-08	75	Std 5~7 Mtr	Kg	3390
220	E150408085	ROUND	E1504~08 / BORON	85	Std 5~7 Mtr	Kg	19442

221	E150408100	ROUND	E1504~08	100	1890	Kg	38535
222	E150408110	ROUND	E1504~08	110	Std 5~7 Mtr	Kg	14782
223	701ZZB0041	ROUND	EN39B	32	Std 5~7 Mtr	Kg	990
224	2GR315001720	ROUND	LW4130VD/4330VD	315	1720	Kg	15820
225	701ZZB0066	ROUND	SAE 5120H / SAE8620H	36	Std 5~7 Mtr	Kg	1236
226	2GR210001075	ROUND	SAE4130HVD	210	1075	Kg	73276

Supply should be in multiple of the cut length.

EOI publishing Date: 09/10/2024
EOI closing date: 08/11/2024 Time 5:00 PM (30 Days)

Subject EOI to be submitted to email id: **bemleoi@beml.co.in**

3. This tender is bound by all Government guidelines attached in the Tender document.

For any clarification, point of contact is given below;
Purushothama G
Deputy General Manager – Corporate Materials
BEML Limited
Telephone: +91-80-22963179
Mail Id: purushothama.g@bemlltd.in
tirthabharati.samal@bemlltd.in

4. Terms and conditions as per Annexure-A.

Terms & Conditions Annexure-A

Sl. No.	Particulars	Terms	Bidder Confirmation (Yes/No)
Mandatory Terms & Conditions			
1	Material Grade	As per the material (TDC/STD) indicated at table above.	
2	Quote	Rate (F.O.R beml div inclusive gst)to be quoted as per tendering unit only. Quarterly Pricing based on index published in website like eaindusty.nic.in can be considered	
3	Delivery Terms	F.o.R Beml. (KGF, Mysore, Palakkad,Bengaluru) EXW is not acceptable.	
4	Delivery Schedule	Jan'2025 till Dec' 2025	
5	Payment terms	Payment terms is 60 days from receipt and acceptance of material / LC -90 days can be considered subject to approval by beml management. For MSME firms, as per MSME act. MSE vendors payment through TReDs. Advance payment terms are not acceptable.	
6	MOQ	Buyer may quote MOQ, however, final qty is on BEML discretion. BEML reserves right for reduction in qty post tender.	
7	Local content	Firm shall submit the local content 50% as per Make in India for Class I and 20% for Class II Supplier	
8	Supplier Mill TC/ NABL TC	EOI is invited only from OE/MILL Supplier. Bidder should submit Mill /LAB/ NABL TC. Mill should have testing facility to ensure supplies are as per BEML TDC. Stockist and traders are not eligible. In case agents are quoting mill authorisation is mandatory. Format MA is attached herewith. Only Class-1 Indian mills with ISO certification and quality management systems are eligible. In case of class-2 source vendor should disclose the raw material source and Indian works address where value addition is done.	
9	Supply condition	Bidder should supply each size from one heat only and supply should be with both MILL and NABL TC. Mandatory. Vendors who do not have beml vendor code will be evaluated by visit of our quality assurance team and developmental order will be placed thorough a separate tender. Post allotment of permanent vendor code these vendors will be allowed to participate in beml regular tenders in GeM/SRM portal. Vendor having BEML Vendor Code need not to quote for this EOI.	

10	Deferent Clause	PO is subject to deferment, re-scheduling, cancellation, Short / Pre-closure based on equipment sales order	
11	PBG	Successful bidder should submit Bank Guarantee @ 5% of PO/ contract Value.	
12	LD Clause	LD Applicable for late deliveries.	
13	Offer validity	90 days from tender opening date	
14	PAST PERFORMANCE	PO copies of Supplies to other PSUs	

Note: Invoice to be generated at delivery plant GST only.

Bidder's declaration

I hereby confirm to supply as per above terms & conditions.

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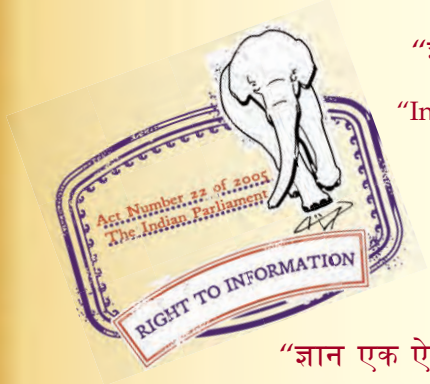
IS 4432 (1988): Case hardening steels [MTD 16: Alloy Steels and Forgings]



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"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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UDC 669·15·018·298·2-422

IS : 4432 - 1988

(Reaffirmed 2004)

Indian Standard

SPECIFICATION FOR CASE HARDENING STEELS

(First Revision)

Alloy Steels and Special Steels Sectional Committee, SMDC 19; Panel for Case Hardening Steels, SMDC 19 : P16 [Ref : Doc : SMDC 19 (3074)]

1. Scope — Covers the technical delivery requirements for wrought low carbon unalloyed and alloyed steel bars, billets, rods and finished forgings for case-hardening.

1.1 The steels are, in general, intended for forgings and fabrication of case-hardened machine or automobile parts.

1.2 Case-hardening of parts means which are carburized or carbonitrided on their surface and subsequently hardened to produce a high degree of hardness in the surface zone, whilst the core material is characterized by relatively good toughness.

2. Supply of Material — General requirements relating to the supply of the material shall conform to IS : 1387-1967 'General requirements for the supply of metallurgical materials (*first revision*)'.

2.1 While placing an order, the information to be given by the purchaser is given in Appendix A.

2.2 Steels covered in this standard shall be ordered and delivered on any one of the following basis.

Requirements	*Types of Condition of Delivery*								
	A	B	C	D	E	F	G	H	I
Chemical composition	×	×	×	×	×	×	×	×	×
Hardness:		×	×	×	×	×	×	×	×
Maximum value, as wrought Or Maximum value, as annealed/HT Or Range, as treated for improved machinability									
Mechanical properties for simulated Case-hardened test bars			×				×	×	
Grain size (McQuaid Ehn)				×				×	×
Hardenability					×				×
Cleanliness, in step-down test						×	×		×

Note 1 — Other mode of deliveries, if justified by the quality requirements of the parts either for manufacturing or for end-use, can be specially agreed to at the time of enquiry and order.

Note 2 — For mode of deliveries with hardenability/mechanical properties guarantee minor variation from chemical composition from Table 1 is permissible.

Note 3 — For closer band of hardenability and acceptance level of cleanliness by step-down test, agreement should be made at the time of enquiry and order.

Note 4 — Cleanliness rating in step-down test is not applicable to re-sulphurized steels.

3. Manufacture — Unless otherwise agreed to in the order, the processes used in making the steel and the product shall be left to the discretion of the manufacturer, but the steel shall be fully killed. When so desired, the purchaser shall be informed of the steel making process.

For steels in specially treated condition, like electro-flux refined, vacuum degassed, secondary refined, the steel making process should be agreed to at the time of enquiry and order. However, for continuously cast steels and reduction ratio between the cast product and final product shall be as agreed to between the purchaser and the manufacturer.

3.1 The steels may be made by agreement with the addition of micro alloying elements like titanium, niobium, vanadium, boron, etc, either individually or in combination.

Adopted 15 March 1988

Gr 6

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4. Freedom from Defects — The material shall be free from such surface and internal defects which may impair the forgeability of the steel and/or adversely influence the mechanical properties of the parts.

The method of evaluation surface and internal defects and the allowable limits shall be mutually agreed to at the time of enquiry and order.

4.1 Removal of surface defects, by appropriate means, shall be permitted provided that the remaining dimension after defects removal is not less than that specified at any point of the bar or billet, etc, and that the operation is not likely to affect the processing of the material. Removal of surface defects beyond this level may be permitted only on the approval of the purchaser.

5. Chemical Composition — The ladle analysis of steel shall be as given in Table 1. The analysis of steel shall be carried out either by the method specified in IS : 228 'Methods for chemical analysis of steels (issued in parts)' and its relevant parts or any other established instrumental/chemical method.

In case of dispute, the procedure given in IS : 228 and its relevant parts shall be the refree method. However, where the method is not given in IS : 228 and its relevant parts, the refree method shall be agreed to between the purchaser and the manufacturer.

5.1 Steel, other than free cutting steel, in Table 1 can be ordered in combination of sulphur and phosphorus as below:

	Sulphur	*Phosphorus*
Limit 1	0.045 *Max*	0.045 *Max*
Limit 2	0.020-0.035	0.035 *Max*

Note — For grades specifying sulphur range according to Limit 2, a letter 'S' shall be added at the end of grade designation, for example, 20Mn5Cr5-S.

5.2 *Check Analysis* — The check analysis shall be carried out on the finished product. The permissible variation of check analysis from the limits, specified in Table 1 and **5.1** shall be as given in Table 2.

5.3 Elements not specified in Table 1 shall not be added to the steels except where agreed to other than for the purpose of finishing the heat, and shall not exceed the following limits, if present:

Constituent	*Percent, Max*
Chromium	0.30
Nickel	0.30
Copper	0.25
Vanadium	0.05
Molybdenum	0.05

Note 1 — All reasonable precautions shall be taken to prevent the addition, from scrap or other material used in manufacture, of such elements which affect the hardenability, mechanical properties and applicability.

Note 2 — Trace elements (Ni+Cr+Mo) added together shall not exceed 0·50 percent.

Note 3 — Cu+10(Sn) in the steel shall not exceed 0·50 percent.

6. Heat-Treatment — Recommended temperature for hot-working and heat-treatments aimed at controlling the hardness, machinability, shearability, etc, are given in Table 3 for guidance only.

6.1 Conditions for heat treating test bars and treatment of the steels, in order to comply with the properties specified in Table 4, shall be as given in Table 5.

6.2 Only steels with inherently fine grain structure may be subjected to single quench heat-treatment, provided the test bars comply with the mechanical properties specified in Table 4.

7. Hardness

7.1 The hardness requirements for steels delivered in the conditions 'as-rolled' (*R*), 'annealed to maximum hardness' (*A*), or 'treated to improve machinability' (*M*) shall be as in Table 6.

TABLE 1 CHEMICAL COMPOSITION OF CASE HARDENING STEELS

(*Clause* 5)

Sl No.	Steel Designation	Constituents							
		C Percent	Si Percent	Mn Percent	Ni Percent	Cr Percent	Mo Percent	S Percent	P Percent
i)	10C4	0·15 *Max*	0·15-0·35	0·30-0·60	—	—	—	0·045 *Max*	0·045 *Max*
ii)	15C8	0·10-0·20	0·15-0·35	0·60-0·90	—	—	—	0·035 *Max*	0·035 *Max*
iii)	10C8S10	0·15 *Max*	0·15-0·35	0·60-0·90	—	—	—	0·08-0·13	0·035 *Max*
iv)	11C10S25	0·08-0 18	0·10-0·35	0·80-1·20	—	—	—	0·20-0·30	0·045 *Max*
v)	14C14S14	0·10-0·18	0·10-0·35	1·20-1·50	—	—	—	0·10-0·18	0·045 *Max*
vi)	15Cr3	0·12-0·18	0·15-0·35	0·40-0·60	—	0·50-0·80	—	0·035 *Max*	0·035 *Max*
vii)	16Mn5Cr4	0·14-0·19	0·15-0·35	1·00-1·30	—	0·80-1·10	—	0·035 *Max*	0·035 *Max*
viii)	20Mn5Cr5	0·17-0·22	0·15-0·35	1·00-1·40	—	1·00-1·30	—	0·035 *Max*	0·035 *Max*
ix)	14CrNi6	0·12-0·17	0·15-0·40	0·40-0·60	1·40-1·70	1·40-1·70	—	0·035 *Max*	0·035 *Max*
x)	15Ni5Cr4Mo1	0·12-0·18	0·15-0·35	0·60-1·00	1·00-1·50	0·75-1·25	0·08-0·15	0·035 *Max*	0·035 *Max*
xi)	15Ni7Cr4Mo2	0·12-0·18	0·15-0·35	0·60-1·00	1·5 -2·0	0·75-1·25	0·10-0·20	0·035 *Max*	0·035 *Max*
xii)	16Ni3Cr2	0·12-0·20	0·15-0·35	0·60-1·00	0·60-1·00	0·40-0·80	—	0·035 *Max*	0·035 *Max*
xiii)	20Ni7Mo2	0·17-0·22	0·15-0·35	0·40-0·65	1·65-2·00	—	0·20-0·30	0·035 *Max*	0·035 *Max*
xiv)	20Ni2Cr2Mo2	0·18-0·23	0·15-0·35	0·70-0·90	0·40-0·70	0·40-0·60	0·15-0·25	0·035 *Max*	0·035 *Max*
xv)	20Ni7Cr2Mo2	0·17-0·22	0·15-0·35	0·45-0·65	1·65-2·00	0·40-0·60	0·20-0·30	0·035 *Max*	0·035 *Max*
xvi)	13Ni13Cr3	0·10-0·15	0·15-0·35	0·40-0·70	3·00-3·50	0·60-1·00	—	0·035 *Max*	0·035 *Max*
xvii)	21Cr4Mo2	0·26 *Max*	0·10-0·35	0·60-0·90	—	0·90-1·20	0·15-0·30	0·035 *Max*	0·035 *Max*

Note 1 — For steels in Sl No. vi-xv, sulphur and phosphorus range can also be ordered according to **5.2**. When ordered as Limit 2 of **5.2**, add a letter 'S' at the end of grade designation, for example, 16Mn5Cr4-S.

Note 2 — Drop forging and case hardening are not generally recommended for high sulphur free cutting steel, for example, 11C10S25. However, this is at the option of users. The condition fully killed may not be applicable to these steel grades.

Note 3 — In case of steel with guaranteed hardenability, minor variation in ladle analysis from this table is permissible.

Note 4 — Steel, when ordered according to chemistry only (mode A delivery), the product analysis is to be guaranteed according to this table in conjunction with Table 2.

TABLE 2 PERMISSIBLE VARIATION IN CHECK ANALYSIS

(*Clause* 5.2)

Element	Permissible Content in Ladle Analysis Percent	Permissible Variation in Product Analysis Percent
C	⩽0·23	±0·02
Si	⩽0·40	±0·03
Mn	⩽1·00	±0·04
	>1·00—⩽1·5	±0·06
P	⩽0·045	±0·005
*S	⩽0·045	±0·005
Cr	⩽1·70	±0·05
Ni	⩽1·00	±0·03
	>1·00—⩽2·00	±0·05
Mo	⩽0·30	±0·03

Note 1 — Steel ordered with sulphur Limit 2 should not have less than 0·017 percent sulphur in the product, unless otherwise agreed.

Note 2 — ± means that in one cast the deviation may occur over the upper value or under the lower value of the specified range in Table 1 but not both at the same time.

*For re-sulphurized steel grades, permissible variation in 'S' will be according to IS : 4431-1978 'Specification for carbon and carbon-manganese free-cutting steel (*first revision*)'.

TABLE 3 RECOMMENDED TEMPERATURE OF HOT-WORKING AND HEAT-TREATMENT FOR CONTROLLING HARDNESS, MACHINABILITY SHEARABILITY, ETC

(*Clause* 6)

Sl No.	Type of Steel	Full Annealing (*A*) Temperature °C	Specially Treated for Good Machinability (*M*)		Hot-working Temperature Range °C	Normalizing Temperature °C
			Sub-critical Anneal for Softening, °C After Normalizing	Isothermally transformed		
i)	10C4	900-930	650-700	Isothermally transformed to ferrite and pearlite structure without bainite as per respective transformation diagrams	1 100-850	880-910
ii)	15C8					
iii)	10C8S10					
iv)	11C10S25					
v)	14C14S14					
vi)	15Cr3	880-910	650-700		1 100-850	880-910
vii)	16Mn5Cr3	860-900	650-700		1 150-850	840-870
viii)	20Mn5Cr5					
ix)	14CrNi6					
x)	15Ni5Cr4Mo1	860-880	650-700		1 150-850	840-870
xi)	15Ni7Cr4Mo2					
xii)	16Ni3Cr2					
xiii)	20Ni7Mo2	860-880	650-700		1 150-850	840-870
xiv)	20Ni12Cr2Mo2					
xv)	20Ni7CrMo2					
xvi	13Ni15Cr3	860-880	850-700		1 150-850	840-870
xvii)	21Cr4Mo3	860-880	650-700		1 150-850	840-870

7.2 Maximum as-rolled hardness for steels for improved cold shearability or the range of hardness for improved machinability, if the values are different from those given in Table 6, shall be mutually agreed at the time of enquiry and order.

7.3 Hardness values given in Table 6 shall be determined in accordance with IS : 1500-1983 'Method for Brinell hardness test for metallic materials (*second revision*)'.

8. Mechanical Properties

8.1 If required, the mechanical properties of the reference test bars after simulated case hardening and tempering in accordance with Table 5 shall conform to the requirements given in Table 4. Values other than specified in Table 4 shall be mutually agreed at the time of enquiry and order.

TABLE 4 MECHANICAL PROPERTIES OF CASE HARDENED STEELS IN CASE CARBURIZED AND HARDENED CONDITION (CORE PROPERTIES ONLY)

(*Clauses* 6.1, 6.2, 8.1 *and* 8.2)

Sl No.	Type of Steel	16 mm Diameter				30 mm Diameter				63 mm Diameter			
		Tensile Strength MPa	Yield Strength MPa (*Min*)	Percent Elongation G.L. (*Min*) $5{\cdot}65\sqrt{A}$	Reduction Area (*Min*)	Tensile Strength MPa	Yield Strength MPa (*Min*)	Percent Elongation G.L. (*Min*) $5{\cdot}65\sqrt{A}$	Reduction Area (*Min*)	Tensile Strength MPa	Yield Strength MPa (*Min*)	Percent Elongation G.L. (*Min*) $5{\cdot}65\sqrt{A}$	Reduction Area (*Min*)
i)	10C4	550-800	330	13	40	500-650	300	16	45	—	—	—	—
ii) iii) iv)	15C8 / 10C8S10 / 11C10S25	600-850	400	12	35	550-800	330	14	40	—	—	—	—
v) vi)	14C14S14 / 15Cr3	650-900	430	12	35	600-900	360	14	40	—	—	—	—
vii)	16Mn5Cr4	850-1 100	620	9	30	800-1 050	600	10	40	650-950	450	11	40
viii)	20MnCr5	1 000-1 300	750	7	25	1 000-1 300	700	8	30	800-1 100	550	10	35
ix)	14CrNi6	1 050-1 350	720	8	35	970-1 300	700	9	40	800-1 100	550	11	40
x)	15Ni5Cr4Mo1	1 050-1 350	720	8	35	1 000-1 350	700	9	35	900-1 200	600	11	40
xi)	15Ni7Cr4Mo2	1 100-1 400	750	9	40	1 050-1 400	730	10	40	800-1 100	550	12	45
xii)	16Ni3Cr2	1 100-1 400	750	8	35	1 050-1 400	720	9	40	900-1 200	600	11	45
xiii)	20Ni7Mo2	800-1 150	550	8	35	700-1 000	500	9	35	650-950	450	10	40
xiv)	20Ni2Cr2Mo2	850-1 200	600	8	35	800-1 150	550	9	35	750-1 050	520	10	40
xv)	20Ni7Cr2Mo2	950-1 350	650	8	35	850-1 200	600	9	35	800-1 150	550	10	40
xvi)	13Ni13Cr3	1 000-1 300	720	8	35	900-1 250	650	9	35	850-1 200	600	10	40
xvii)	21Cr4Mo2	1 100-1 400	750	8	35	1 000-1 350	700	9	40	950-1 250	650	10	40

TABLE 5 RECOMMENDED CONDITIONS FOR HEAT-TREATMENT FOR ACHIEVING PROPERTIES AS PER TABLE 4 IN ADDITION TO OTHER HEAT-TREATMENTS PERTAINING TO CASE-CARBURIZED STEELS

(*Clauses* 6.1 *and* 8.1)

Sl No.	Type of Steel	Jominy (End Quench) Test Quenching, °C	Carburizing Temperature °C	Direct and Single Hardening Temperature °C	Double Hardening		Quenching Media	Tempering Temperature °C
					Core Hardening Temperature °C	Case Hardening Temperature °C		
i)	10C4	—	900-940	830-860	880-900	780-820	Water/Thermal-bath at 140-220°C	150-180
ii)	15C8	—	900-940	830-860	870-890	780-820	Water/Thermal-bath at 140-220°C	150-180
iii)	10C8S10							
iv)	11C10S25							
v)	14C14S14	—	890-940	820-850	870-890	780-820	Oil/Water	170-200
vi)	15Cr3							
vii)	16Mn5Cr4	870±5	890-940	810-840	860-880	790-830	Oil/Thermal-bath/Poly Quench	170-200
viii)	20MnCr5							
ix)	14CrNi6							
x)	15Ni5Cr4Mo1	870±5	890-940	810-840	840-880	780-820	Oil/Thermal-bath/Poly Quench	180-220
xi)	15Ni7Cr4Mo2							
xii)	16Ni3Cr2							
xiii)	20Ni7Mo2	870±5	890-940	810-840	830-870	780-820	Oil/Thermal-bath/Poly Quench	180-220
xiv)	20Ni2Cr2Mo2							
xv)	20Ni7Cr2Mo2							
xvi)	13Ni13Cr3	870±5	890-940	810-840	860-880	790-830	Oil/Thermal-bath/Poly Quench	180-220
xvii)	21Cr4Mo2	870±5	890-940	810-840	840-880	780-820	Oil/Thermal-bath/Poly Quench	180-220

Note 1 — Thermal-bath also includes use of suitable salt baths.

Note 2 — For direct and single quenched process, fully aluminium killed fine grained steel should be used.

Note 3 — Temperature given in the table are for guidance, the actual temperatures choosen should be those that will give the required properties.

Note 4 — If the steel is direct hardened, in general, a carburizing temperature of 940°C is not exceeded.

Note 5 — Time for austenitizing, as a guide, can be taken as 45 minutes for 25 mm section and time for tempering, as a guide, can be taken as 1 h *Min* but preferably 90 minutes.

Note 6 — The kind of quenching media depends on the shape of the product, cooling conditions, etc. For control distortion, use lower hardening temperature with suitable mild quenching media.

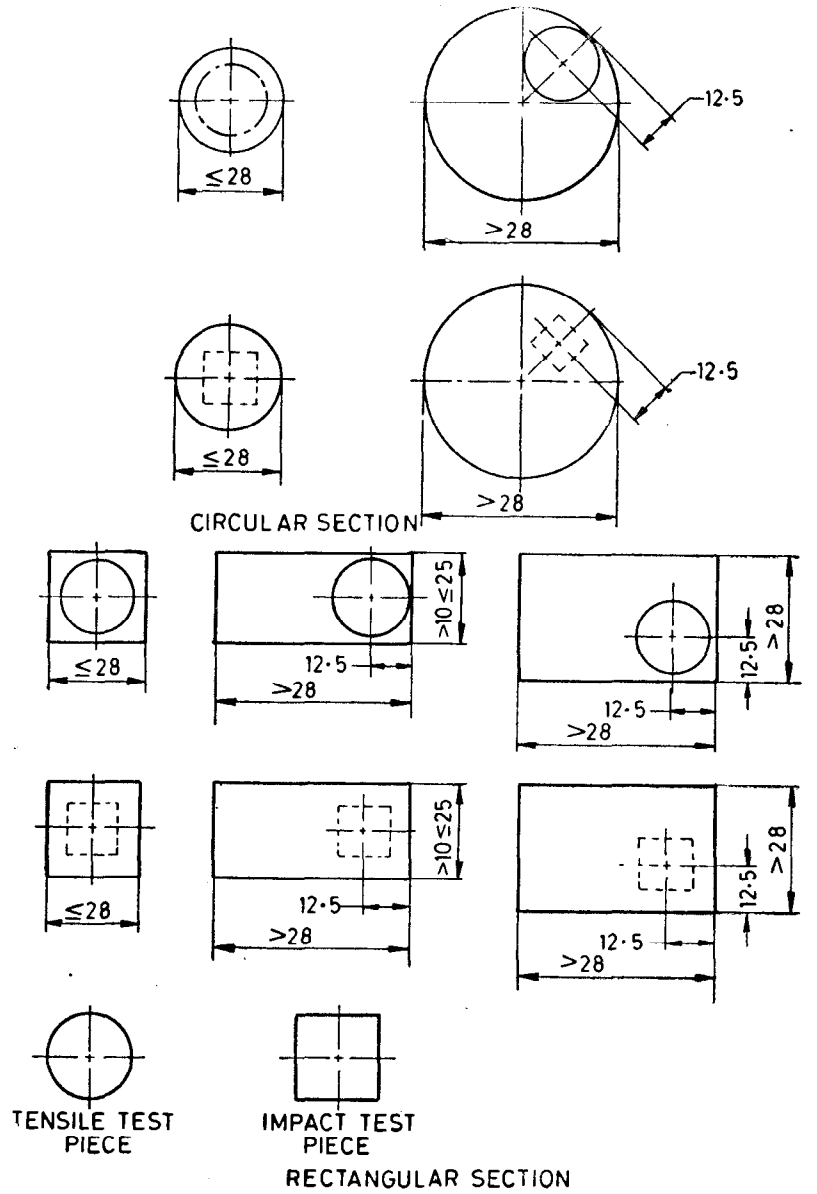
TABLE 6 HARDNESS REQUIREMENT FOR PRODUCTS DELIVERED IN AS-ROLLED CONDITION (*R*), ANNEALED (*A*), OR IMPROVED MACHINABILITY (*M*)

(*Clauses* 7.1, 7.2 *and* 7.3)

Sl No.	Type of Steel	Brinell Hardness (HB) in the Condition			
				M	
		R (*Max*)	*A* (*Max*)	*Min*	*Max*
i)	10C4	—	131	90	145
ii)	15C8	180	150	105	170
iii)	10C8S10				
iv)	11C10S25				
v)	14C14S14				
vi)	15Cr3	202	174	120	180
vii)	16Mn5Cr4	235	207	150	202
viii)	20Mn5Cr5	249	217	160	210
ix)	14CrNi6	235	217	160	210
x)	15Ni5Cr4Mo1	263	229	170	220
xi)	15Ni7Cr4Mo	263	229	170	220
xii)	16Ni3Cr2	249	207	150	202
xiii)	20Ni7Mo2	249	217	160	210
xiv)	20Ni2Cr2Mo2	249	217	170	220
xv)	20Ni7Cr2Mo2	263	229	170	220
xvi)	13Ni13Cr3	235	217	160	210
xvii)	21Cr4Mo2	249	217	170	210

Note — For improved machinability, the steel should be heat-treated to a ferrite pearlite structure such as by processes like isothermal annealing or normalizing followed by subcritical tempering, if necessary, to temper down incidental bainite and also partially breakdown the dense pearlite.

8.2 The properties given in Table 4 shall be applicable to test bars taken on rounds in the direction of the rolling fibre, the axis of which corresponds to Fig. 1.



All dimensions in millimetres.

FIG. 1 LOCATION OF THE TEST PIECES IN THE PRODUCTS TO BE DELIVERED

8.3 For rectangular sections, the ranges for equivalent sections shall be as given in Fig. 2.

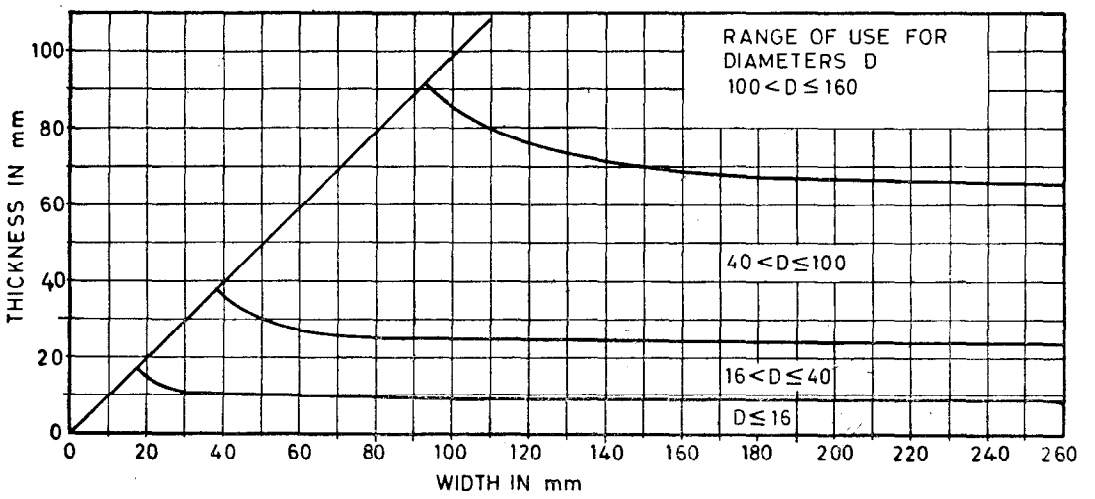


FIG. 2 APPLICABILITY OF THE VALUES, GIVEN IN TABLE 4 FOR ROUND SECTION, TO RECTANGULAR SECTION OF OIL OR WATER-QUENCHED PRODUCTS

8.4 Methods for determining the mechanical properties specified in Table 4 shall be in accordance with IS : 1598-1977 'Method for izod impact test of metals (*first revision*)' and IS : 1608-1972 'Method for tensile testing of steel products (*first revision*)'.

9. Grain Size

9.1 Unless otherwise agreed, the steel when tested for grain size in accordance with IS : 2853-1964 'Method of determining austenitic grain size of steel' shall show an austenitic McQuaid Ehn grain size in the range of 5 to 8 for inherently fine grained steels.

9.1.1 Grain size outside the range of 5 to 8 may, however, be supplied on request or on mutual agreement.

9.1.2 The grain size specification shall be considered satisfactory if 75 percent of grains are within the specified size limits, but the remaining 25 percent of the grains falling either one size below or above the range and not spreaded at both ends of the range.

10. Cleanliness of the Steel

10.1 Inclusion rating of the steel shall be determined in accordance with IS : 4163-1967 'Method for determination of inclusion content in steel by microscopic method (*first revision*)'. The worst field of each inclusion from each specimen shall be recorded as a rating for the specimen. The inclusion rating for the specimens shall not exceed the following limits:

	Rating							
	A		*B*		*C*		*D*	
	Th	Tk	Th	Tk	Th	Tk	Th	Tk
a) For air melted quality	3	2	3	2	3	2	3	2
b) For vacuum, EFR or secondary refined quality	Subject to mutual agreement							

10.2 When required and ordered, cleanliness of the steel can also be assessed by step-down test and magnetic particle test method according to IS : 10138 (Part 2)-1983 'Macroscopic methods for determination of non-metallic inclusion content in wrought steels : Part 2 Step machined test method' and IS : 10138 (Part 3)-1983 'Macroscopic methods for determination of non-metallic inclusion content in wrought steels : Part 3 Magnetic particle inspection method', or as agreed to at the time of enquiry and order.

The acceptance level of non-metallic inclusions shall be mutually agreed keeping in view of the process limitations and end use of the material. However, this clause is not applicable for re-sulphurized steel grades according to Table 1.

11. Dimensional Tolerances

11.1 The dimensional tolerances for hot rolled steel products shall be in accordance with IS : 3739-1987 'Dimensional tolerances for carbon and alloy constructional steel (*first revision*)'. Any additional stipulations on dimensions may be mutually agreed at the time of enquiry and order, if the forging process or the product so calls for.

11.2 For forged steel bars, billets, blooms, etc, the tolerance shall be in accordance with IS : 3469 (Parts 1 to 3)-1974 'Tolerances for closed die steel forgings (*first revision*)'.

11.3 *Tolerances on Straightness* — Unless otherwise agreed to between the purchaser and manufacturer, the steels shall be supplied in hot-bed straightened condition with the following limits:

Nominal Size/Section	*Permissible Deviation from Straightness*
40 mm and below	6 mm/metre length, *Max*
41 to 80 mm	4 mm/metre length, *Max*
81 to 200 mm	3 mm/metre length, *Max*

12. Sampling

12.1 *Sampling for Chemical Analysis* — The ladle analysis shall be supplied by the manufacturer. If the product analysis is required by the purchaser, at least one sample product shall be taken from each cast.

12.1.1 For product analysis, the selection of samples shall be carried out. The selection of samples shall be as agreed to mutually between the supplier and the purchaser.

12.2 *Sampling for Hardness in the Normalized or Annealed Condition* — One sample product shall be taken from each heat-treatment batch for the determination of hardness.

12.3 *Sampling for Mechanical Properties* — If the material is supplied on the basis of core properties of test bars after case hardening, one sample product shall be taken from each size grouping for heat-treatment and testing.

12.3.1 Test pieces for mechanical tests shall be taken in the longitudinal direction of the product in accordance with Fig. 1.

12.4 General condition for selection and preparation of samples and test pieces shall be in accordance with IS : 3711-1966 'Method for selection and preparation of samples and test pieces for mechanical tests for wrought steel'.

13. Retests

13.1 *Retest for Product Analysis* — If the results of the product analysis do not meet the composition requirements given in Tables 1 and 2, unless otherwise agreed to between the purchaser and the manufacturer, two new samples shall be taken on different pieces from the same cast. Should the two analyses satisfy the requirements, the lot represented shall be accepted. Should either of the tests fail, the material shall be taken as not complying with this standard.

13.2 *Retest for Hardness Test in the Normalized/Annealed Condition* — If the sample selected under **12.2** fails to meet the requirements under **7**, two further samples shall be selected from the same heat-treatment batch. The consignment shall be considered to conform to the requirements if both the additional tests are satisfactory. Should either of the samples fail, the manufacturer shall have the right, if he so desires, to re-heat-treat the product in any suitable manner before two fresh samples are taken for testing. Should the two tests satisfy the requirements of this standard, the lot represented shall be accepted. Should either of the samples fail, the material shall be taken as not complying with this standard.

13.3 *Retest for Mechanical Tests on Test Pieces* — If the sample selected under **12.3** fails to meet the requirements under **8**, two further samples shall be selected from the same size grouping for making fresh test bars. The fresh test bars, shall be case hardened, turned and tested. The consignment shall be considered to conform to the requirements if both the additional tests are satisfactory. Should either of the test pieces fail, the material shall be taken as not complying with this standard.

14. Additional Tests

14.1 If agreed to between the purchaser and the manufacturer at the time of enquiry and order, any or a combination of the following tests may also be carried out to ensure that the steels meet the quality requirements of the purchaser:

a) Macroetch test in accordance with IS : 11371-1985 'Method for macroetch test of wrought steel products',

b) Ultrasonic test in accordance with IS : 3664-1981 'Code of practice for ultrasonic pulse echo testing by contact and immersion methods (*first revision*)',

c) Hardenability test in accordance with IS : 3848-1981 'Method for end quench test for hardenability of steel (*first revision*)',

d) Blank hardening test for core strength guarantee according to recommendations of Table 7,

e) Cleanliness test by 'Blue fracture test' according to IS : 10138 (Part 1)-1982 'Macroscopic methods for determination of non-metallic inclusion content in wrought steels : Part 1 Blue fracture test method',

f) Microstructure for machinability including banding, and

g) Hot up-set test for forgeability.

14.2 The acceptance level for each or any of these tests shall be mutually agreed to at the time of enquiry and order.

15. Marking

15.1 All bars of 40 mm dia or equivalent section and above shall be stamped or suitably marked at the end with material designation, heat number and name or trade-mark of the manufacturer. Bars of smaller sections shall be tied in suitable bundles which will carry metal tags giving the information.

TABLE 7 RECOMMENDED HARDENABILITY AND BLANK HARDENED VALUES FOR STEELS AS PER TABLE 1

[*Clause* 14.1 (*d*)]

Sl No.	Type of Steel	Blank Hardened Values in HRC	Jominy Hardenability Values Hardness in HRC at a Distance from the Quenched End Face in mm				
			1·5 mm	5 mm	20 mm	30 mm	40 mm
i)	10C4	—	—	—	—	—	—
ii)	15C8	—	—	—	—	—	—
iii)	10C8S10	—	—	—	—	—	—
iv)	11C10S25	—	—	—	—	—	—
v)	14C14S14	—	—	—	—	—	—
vi)	15Cr3	28	47 *Max*	44 *Max*	31 *Max*	28 *Max*	—
vii)	16Mn5Cr4	30	39 *Min*	31 *Min*	—	—	—
viii)	20Mn5Cr5	35	41-49	36-48	23-37	20-34	30 *Max*
ix)	14CrNi6	34	39-47	36-46	24-37	21-34	20-30
x)	15Ni5Cr4Mo1	35	36-47	36-46	26-38	24-35	22-30
xi)	15Ni7Cr4Mo2	35	39-48	37-41	28-42	25-38	24-37
xii)	16Ni3Cr2	34	36-45	26-41	30 *Max*	—	—
xiii)	20Ni7Mo2	34	41-48	26-42	32 *Max*	—	—
xiv)	20Ni2Cr2Mo2	34	41-48	30-44	20-32	—	—
xv)	20Ni7Cr2Mo2	35	41-49	34-47	24-37	20-34	30 *Max*
xvi)	13Ni13Cr3	35	39-47	37-41	26-38	21-34	20-30
xvii)	21Cr4Mo2	34	36-47	36-46	28-42	24-30	22-30

Note 1 — Blank hardening should be carriad out on 30 mm dia turned specimen, taken from the same location of the billet as recommended for tensile test specimen. The blank hardened hardness to be determined at the centre of such a specimen.

Note 2 — Blank hardening temperature for all steels, excepting 15Cr3, should be 870±10°C with 45 min soaking followed by oil quenching. For 15Cr3, the temperature should be 880±10°C, followed by water quenching.

Note 3 — Jominy hardenability test shall be carried out according to IS : 3848-1981.

15.2 The bars, billets, etc, shall be suitably colour coded at the ends to mark the grade of the material. The colour scheme followed can be in accordance with IS : 2049-1978 'Colour code for the identification of wrought steels for general engineering purposes (*first revision*)' according to purchaser's requirement.

15.3 *Standard Marking* — Details are available with the Bureau of Indian Standards.

APPENDIX A

(*Clause* 2.1)

INFORMATION TO BE GIVEN BY THE PURCHASER

A-1. Basis for Order

A-1.1 While placing an order for the steels covered by this standard, the purchaser should specify clearly the following:

a) Grade;

b) Quality;

c) Size;

d) Tests required;

e) Special requirements, such as bundling, packing, etc;

f) Method of manufacture; and

g) Test report, if required.

EXPLANATORY NOTE

This standard was first published in 1967. While reviewing this standard in the light of the experience gained during these years, the Committee has decided to bring it in line with the present practice followed in the country. The Grade designations have been modified.

Printed at Swatantra Bharat Press, Delhi, India

AMENDMENT NO. 1 APRIL 1994
TO
IS 4432 : 1988 SPECIFICATION FOR CASE HARDENING STEELS

(First Revision)

[*Page* 5, *Table* 4, *Sl No.* (viii)] — Under the column 'Type of steel', substitute '20Mn5Cr5' *for* '20MnCr5'.

[*Page* 6, *Table* 5, *Sl No.* (viii)] — Under the column 'Type of steel', substitute '20Mn5Cr5' *for* '20MnCr5'.

(MTD 16)

Reprography Unit, BIS, New Delhi, India

British Standard

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John May

on February 20, 2002

BRITISH STANDARD

BS 970-3:1991

Incorporating Amendment Nos. 1 and 2

Specification for

Wrought steel for mechanical and allied engineering purposes —

Part 3: Bright bars for general engineering purposes

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Iron and Steel Standards Policy Committee (ISM/-) to Technical Committee ISM/31, upon which the following bodies were represented:

Associated Offices Technical Committee
British Chain Manufacturers' Association
British Coal Corporation
British Forging Industry Association
British Industrial Fasteners Federation
British Railways Board
British Steel Industry
Cold Rolled Sections Association
Department of Trade and Industry (National Physical Laboratory)
Engineering Industries Association
Federation of British Engineers' Tool Manufacturers
Lloyds Register of Shipping
Ministry of Defence
National Association of Steel Stockholders
Road Vehicle Spring Society
Society of Motor Manufacturers and Traders Limited
Stainless Steel Fabricators' Association of Great Britain

This British Standard, having been prepared under the direction of the Iron and Steel Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on
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Amd. No.	Date	Comments
7227	September 1992	
8974	November 1995	Indicated by a sideline in the margin

Contents

Foreword

This Part of BS 970 has been prepared under the direction of the Iron and Steel Standards Policy Committee. It supersedes those clauses concerned with bright finished bars in BS 970-1:1983, which is withdrawn.

Technical Committee ISM/31 has decided that requirements for bars supplied in the bright cold finished condition should be withdrawn from BS 970-1:1983 to appear in a separate standard for the sake of clarity and as a preparatory step towards a European Standard for this product range.

This Part of BS 970 specifies the requirements for bright cold finished bars in carbon, carbon manganese, alloy, free-cutting and stainless steels supplied in straight lengths.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 30, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

blank

1 Scope

This Part of BS 970 specifies requirements for carbon and carbon manganese, alloy, free-cutting and stainless steels normally supplied in the bright cold finished condition. It is only applicable to steels supplied in straight lengths.

In addition to the definitive requirements, this Part of BS 970 also requires the items detailed in clause **3** to be documented. For compliance with this Part of BS 970, both the definitive requirements and the documented items have to be satisfied.

Special ordering options to be called up as required by the purchaser are included in appendix A.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Definitions and symbols

2.1 Definitions

For the purposes of this Part of BS 970 the following definitions apply.

2.1.1
bright cold drawn bars

bars of various cross-sectional shapes obtained, after descaling, by drawing of hot rolled bars or rod, through a die (cold deformation without removing material)

NOTE This operation gives the product special features with respect to shape, dimensional accuracy and surface finish. In addition, the process causes cold working of the product, which can be eliminated by subsequent heat treatment. Products in lengths are delivered straightened regardless of size.

2.1.2
bright turned bars

bars of circular cross section having the special features of drawn product concerning shape, dimensional accuracy and bright surface finish with the additional benefit of metal removal on decarburization and surface defectiveness produced by turning

2.1.3
precision ground bars

drawn or turned bars of circular cross section given an improved surface finish and dimensional accuracy by grinding or grinding and polishing

2.1.4
annealing

heat treatment consisting of heating and soaking at a suitable temperature followed by cooling under conditions such that, after return to ambient temperature, the metal will be in a structural state closer to that of equilibrium

NOTE The heat treatments in **2.1.4** to **2.1.7** can be carried out either before or after cold conversion and can result in surface discolouration.

2.1.5
normalizing

heat treatment consisting of austenitizing followed by air cooling to refine the metallurgical structure (See note to **2.1.4**.)

2.1.6
stress relieving

heat treatment including heating and soaking at a suitable temperature followed by cooling at an appropriate rate in order to relieve internal stresses without substantially modifying the structure (See note to **2.1.4**.)

2.1.7
hardening and tempering

heat treatment including heating to a temperature above the upper critical temperature followed by rapid cooling by means of a suitable quenching medium and subsequent reheating to a temperature below the lower critical temperature (See note to **2.1.4**.)

2.1.8
ruling section

the equivalent diameter of that portion of the product at the time of heat treatment that is most important in relation to mechanical properties

2.1.9
limiting ruling section

the largest diameter in which certain specified mechanical properties are achieved after a specified heat treatment

2.1.10
equivalent diameter

the diameter of a hypothetical bar of infinite length of uniform circular cross section which, if subjected to the same cooling conditions as the product, i.e. same initial and final temperature and same cooling medium, would have a cooling rate at its axis equivalent to that at the slowest cooling position in the product or relevant part

2.1.11
test sample

a sufficient quantity of material taken from the sample product for the purpose of producing one or more test pieces

2.1.12
test piece

part of the test sample, with the specified dimensions, machined or unmachined, brought to the required condition for submission to a given test

2.2
symbols

the symbols used in this Part of BS 970 are given in **1.3** of BS 970-1:1991

3 Information and requirements to be agreed and to be documented

3.1 Information to be supplied by the purchaser

The following information to be supplied by the purchaser shall be fully documented.

Both the definitive requirements specified throughout this Part of BS 970 and the following documented items shall be satisfied before a claim of compliance with this Part of BS 970 can be made and verified:

a) details of the form of section, size, length and quantity;

b) the tolerances required on sections (see Table 1 to Table 4);

c) the grade of steel required (see Table 5 and Table 6 and Table 12 to Table 28);

d) the tolerances required on length;

e) surface condition of supply (see clause **12** and Table 7 to Table 11);

f) heat treatment condition together with any physical properties required (see Table 19 to Table 28);

3.2 Options

If the purchaser wishes to take up any of the optional requirements given in this Part of BS 970 (see appendix A), such requirements shall be specified at the time of the enquiry and/or order. In the absence of such information, the manufacturer shall supply in accordance with the basic specification.

3.3 Items for agreement

The following items to be agreed between the contracting parties, which are specified in the clauses referred to, shall be fully documented. Both the definitive requirements specified throughout this Part of BS 970 and the following documented items shall be satisfied before a claim of compliance with the standard can be made and verified.

a) If controlled magnetic properties are required they shall be agreed at the time of enquiry and/or order (see **4.3.2**).

b) If bars shall be supplied with special corrosion protection it shall be specified and agreed at the time of enquiry and/or order (see **4.6**).

c) If any particular type of deoxidation is required it shall be agreed at the time of enquiry and/or order (see **5.1**).

d) If closer dimensional tolerances than those given in Table 1 to Table 4 are required they shall be agreed at the time of enquiry and/or order (see **6.4**).

e) Results based on test bar sizes of 13 mm or 29 mm shall be agreed at the time of enquiry and/or order (see **7.3.1** and **10.4**).

f) If mechanical properties other than those in a longitudinal direction are required values shall be agreed at the time of enquiry and/or order (see **7.4.2**).

g) If a particular grain size range is required it shall be supplied and the method of measurement agreed at the time of enquiry and/or order (see **8.5**).

h) If restrictions on certain elements in the chemical composition ranges are required this shall be agreed at the time of enquiry and/or order (see **9.1**).

i) If controlled sulfur and phosphorus ranges other than those specified in Table 12 to Table 18 are required they shall be agreed at the time of enquiry and/or order (see **9.1**).

j) If specific non-destructive testing is required the inspection technique and the inspection limits shall be agreed at the time of enquiry and/or order (see **12.1** and **12.3.1.4**).

k) If specific cleanness requirements are required the relevant standard criteria shall be agreed at the time of enquiry and/or order (see **12.2**).

l) If a maximum decarburization limit is required the level shall be agreed at the time of enquiry and/or order and measured in accordance with BS 6617-1 and BS 6617-2 (see **12.4**).

m) If end stamping or colour coding is required it shall be agreed at the time of enquiry and/or order (see clause **13**).

4 General

4.1 Steel products

Steel products shall comply with the specific requirements of this Part of BS 970 and with the specific requirements applicable to the grade concerned. Where any of the options given in appendix A are called up at the time of the enquiry and/or order, the steel products shall, comply with the requirements of any such options.

4.2 Carbon, carbon manganese, free-cutting and alloy steels

Where mechanical properties are obtained by heat treatment, the treatment given to the test bars and to material required in the finally heat treated condition shall be as given in Table 19 to Table 28. Unless otherwise specified at the time of enquiry and/or order bars supplied in the non-heat treated condition shall not be hardness tested. (See also option **A.1**.)

4.3 Stainless steels

4.3.1 *Ferritic steels*

When bright bars are supplied in the hardened and tempered condition, the heat treatment shall be given either before or after any cold sizing

NOTE Bright bars of ferritic steel supplied in the softened condition can be treated before or after any cold sizing.

4.3.2 *Austenitic steels*

When bright bars are supplied in the softened condition the heat treatment shall be given before drawing, turning or grinding.

NOTE If controlled magnetic properties are required, see **3.3** a).

4.3.3 *Martensitic steels*

Bright bars of martensitic steels shall be supplied in the condition given in Table 23.

4.4 Specific requirements of Table 12 to Table 28

The specific requirements given in Table 12 to Table 28 shall apply to the following:

a) close limits of chemical composition (A grades) where no mechanical or hardenability requirements are specified;

b) specified mechanical properties (M grades);

NOTE Variations from the specified chemical composition range are permissible provided that the stipulated mechanical properties are attained.

c) specified hardenability properties (H grades).

NOTE Properties given in the appropriate hot rolled steel bar standard will apply.

4.5 Cast analysis

The manufacturer shall supply a certificate stating the cast analysis of the material. (See also option **A.2**)

4.6 Corrosion protection

The manufacturer shall supply bars with a coating of a corrosion protection medium. (See also **3.3** b).)

5 Steelmaking process and casting methods

5.1 Steelmaking

Steelmaking shall be by any process except the air or mixed air and oxygen bottom blown basic conversion process. (See also **3.3** c).)

5.2 Casting method

The steel shall be cast into ingots or continuously cast blooms or billets (see **12.1**).

NOTE For the purposes of Table 7 steel 230M07 is supplied as a balanced quality. The other steels listed in Table 12 are supplied as killed free-cutting qualities.
Steels listed in Table 13 are supplied as killed carbon steels.
Steels listed in Table 14 are supplied as killed carbon or killed coarse grain steels depending upon ordered requirements. Steels in Table 15 and Table 16 are classified as low alloy steels.

6 Dimensional tolerances

6.1 Sectional tolerances

6.1.1 Bars shall be supplied to the sectional tolerances given in Table 1 to Table 3.

Table 1 — Tolerances for cold drawn bar

Section	Size, diameter or width across flats	Permitted variation
	mm	mm
Round	≥ 6 ≤ 18	+ 0 to – 0.070
	> 18 ≤ 30	+ 0 to – 0.085
	> 30 ≤ 50	+ 0 to – 0.100
	> 50 ≤ 80	+ 0 to – 0.120
	> 80 ≤ 100	+ 0 to – 0.140
Square and hexagon	≥ 6 ≤ 18	+ 0 to – 0.090
	> 18 ≤ 30	+ 0 to – 0.110
	> 30 ≤ 50	+ 0 to – 0.130
	> 50 ≤ 80	+ 0 to – 0.160
	> 80 ≤ 105	+ 0 to – 0.250
Flat (width)	< 18	+ 0 to – 0.110
	> 18 ≤ 30	+ 0 to – 0.130
	> 30 ≤ 50	+ 0 to – 0.160
	> 50 ≤ 80	+ 0 to – 0.190
	> 80 ≤ 100	+ 0 to – 0.220
	> 100 ≤ 130	+ 0 to – 0.350
	> 130 ≤ 160	+ 0 to – 1.00
	> 160 ≤ 320	+ 1.00 to – 1.00
Flat (thickness)	< 18	+ 0 to – 0.110
	> 18 ≤ 30	+ 0 to – 0.130
	> 30 ≤ 50	+ 0 to – 0.250
	> 50 ≤ 80	+ 0 to – 0.350

6.1.2 Thickness shall be measured within 12 mm of the edge for flats.

6.1.3 The diameter of round bars in the as drawn length shall be measured at a distance of at least 150 mm from the end of the bar. Where round bars have been re-cut to an exact length the diameter shall be measured at least 10 mm from the end of the bar.

6.1.4 The cross-sectional measurement of hexagons, squares and flat bars shall be measured at least 25 mm from the end of the bar.

NOTE The very ends of such bars might not necessarily meet the requirements of Table 1 but these should not be regarded as defective if the remainder is in accordance with Table 1.

Table 2 — Tolerances for turned bars

Size, diameter	Permitted variation
mm	mm
≥ 6 ≤ 18	+ 0 to – 0.070
> 18 ≤ 30	+ 0 to – 0.085
> 30 ≤ 50	+ 0 to – 0.100
> 50 ≤ 80	+ 0 to – 0.120
> 80 ≤ 120	+ 0 to – 0.140
> 120 ≤ 180	+ 0 to – 0.160
> 180 ≤ 250	+ 0 to – 0.185
> 250 ≤ 315	+ 0 to – 0.210
> 315 ≤ 400	+ 0 to – 0.230
> 400	+ 0 to – 0.250

6.2 Tolerances for precision ground bars

6.2.1 The appropriate dimensional tolerance class required shall be as selected by the purchaser (see Table 3). Surface texture shall be 0.8 µm centre line average maximum (0.8 µm R_a max.) in accordance with BS 1134-1.

Table 3 — Tolerances for precision ground bars

Section	Size, diameter	Permitted overall variation		
		Class A	Class B	Class C
	mm	mm	mm	mm
Round	≥ 6 < 75	0.050	0.025	0.013

6.2.2 Maximum deviation from "out of round" shall be no more than half the ordered diametric tolerance, as measured using a 60° 3-point gauge.

6.2.3 Bars with cold sheared ends shall be measured at a distance from the end not less than the diameter of the bar.

6.3 Straightness tolerance

Drawn and turned bars shall be supplied to the tolerances given in Table 4 and shall be measured as maximum deviation from straightness in any 3 000 mm portion of the bar.

Table 4 — Straightness tolerances

Section	Steel grade	Permitted variation
Rounds	< 0.25 % carbon	1 in 1 000
	≥ 0.25 % carbon, alloys and all heat treated grades	1 in 500
Squares and hexagons	< 0.25 % carbon ≤ 75 mm	1 in 750
	< 0.25 % carbon > 75 mm	1 in 500
	≥ 0.25 % carbon, alloys and all heat treated grades	1 in 375
Flats	< 0.25 % carbon	1 in 500
	≥ 0.25 % carbon, alloys and all heat treated grades	1 in 375

6.4 Special tolerances

The basic specification shall comply with the dimensional tolerances given in Table 1 to Table 4, as appropriate. (See also **3.3** d).)

7 Selection and preparation of test samples

7.1 Selection of test samples

One tensile test and where relevant, one Izod impact test sample, comprising three notches, or three Charpy V-notch impact test samples shall be taken from any batch of the same cast.

For the purpose of subsequent orders, these tests shall be taken as representing all sizes of material from the same cast where the ruling section of the parts does not exceed the ruling section of the test bar already tested.

The samples shall be cut from the heat treated bars or cold finished bars and shall not be further heat treated or mechanically worked after their removal.

7.2 Steel of tensile strength of 1 225 N/mm^2 or greater

Where the tensile strength of alloy steel is specified as 1 225 N/mm^2 minimum or greater, the test sample shall be machined to test piece size, plus a grinding allowance if required, before heat treatment.

7.3 Steels for case hardening

7.3.1 *Size of test sample*

The test sample size shall be 19 mm diameter. (See also **3.3** e).)

7.3.2 *Selection of samples*

Subject to **7.3.1** one test sample shall be selected to represent each cast. If the size of the test sample is greater than the specified test piece size, test bars shall be prepared by forging and/or machining to that size; but for sizes smaller than 13 mm diameter for carbon and carbon manganese steels and for sizes smaller than 19 mm diameter for alloy steels, the test pieces shall be heat treated in the full section of the sample.

NOTE The properties specified in Table 19 to Table 26 apply only to the preferred test bar sizes and to ruling sections equivalent to these. When components of different ruling sections are carburized and heat treated, different core properties will be obtained. Similarly, it may be necessary to agree mechanical properties when the test sample size is less than the specified test bar size.

Attention is also drawn to the influence of several factors such as steel composition, ruling section and heat treatment, on the hardness of the case. For example, even if a low core strength suffices it will be necessary to use an alloy steel for acceptable case hardenability of the largest section sizes.

7.3.3 *Heat treatment of test piece*

7.3.3.1 *Carbon and carbon manganese steels*

The test pieces shall be blank carburized for at least 1 h at the hardening temperature between 900 °C and 930 °C and quenched in oil.

7.3.3.2 *Alloy steels*

The test pieces shall be blank carburized for at least 1 h at a temperature between 800 °C and 930 °C. After cooling to room temperature they shall be reheated to the single quenching temperature, as given in Table 22, and quenched in oil.

7.4 Location of test pieces for mechanical testing

7.4.1 *General*

Where longitudinal tests are required, the test piece shall be prepared in accordance with the following:

a) For ruling sections up to and including 25 mm, the test piece shall be machined coaxially from the test bars.

b) For ruling sections over 25 mm, the longitudinal axis of the test piece shall be 12.5 mm from the surface of the test bars.

c) Austenitic stainless steels (see Table 18) supplied as cold drawn bars shall be tested in full section for ruling sections up to and including 19 mm. For ruling sections over 19 mm, the test piece shall be machined coaxially from the test sample.

7.4.2 *Transverse and other tests*

Where transverse and other tests are required the test piece shall be prepared as specified in the enquiry and/or order. (See also **3.3** f).)

7.5 Frequency of other tests

7.5.1 *Number of hardness tests*

The manufacturer shall carry out one test per production batch in accordance with the relevant clauses of this Part of BS 970 in order to ensure that the material complies with the specified hardness.

7.5.2 *Number of hardenability tests*

One test sample selected to represent each cast shall be reduced by forging or rolling to a size not greater than 38 mm diameter which shall represent the full cross section of the material. This test bar shall also be of sufficient size to ensure the complete removal of decarburization in machining to the standard test piece of 25 mm diameter.

8 Test methods and test results

8.1 Tensile test

8.1.1 The tensile test shall be carried out in accordance with BS EN 10002-1.

8.1.2 The specified mechanical properties shall refer to tests taken in the longitudinal direction.

8.1.3 In cases of dispute tensile test pieces shall be machined from bars to the dimensions of the 11.28 mm diameter (100 mm^2 cross-sectional area) test piece or, if the test sample is too small, to the dimensions of the largest recommended round test piece that can be obtained having a gauge length equal to $5.65\sqrt{S_O}$.

8.1.4 For material not greater than 15 mm diameter or width across flats, unmachined test pieces having a gauge length equal to $5.65\sqrt{S_O}$ shall be used.

8.2 Impact test

The impact properties shall be determined in accordance with BS 131-1. (See also option **A.3**)

8.3 Hardness test

The Brinell hardness test shall be carried out in accordance with BS 240.

8.4 Hardenability test

Hardenability tests shall be carried out in accordance with the appropriate method of BS 4437.

8.5 Grain size test

Grain size tests shall be carried out in accordance with the appropriate method given in BS 4490. (See also **3.3** g).)

8.6 Intercrystalline corrosion test

If an intercrystalline corrosion test is required it shall be as specified at the time of enquiry and/or order. (See also option **A.4**)

9 Chemical composition

9.1 Composition ranges

The chemical composition of the steel, based on cast analysis when tested in accordance with BS 6200 shall comply with the appropriate material specifications given in Table 12 to Table 18. (See also **3.3** h), **3.3** i) and option **A.5**)

NOTE In Table 12 to Table 28 figures in parentheses indicate notes which appear at the end of these tables.

9.2 Residual elements

The maximum limits on residual elements shall be as given in Table 5.

Table 5 — Maximum limits on residual elements

Element	Carbon and carbon manganese grades	Non-austenitic stainless grades	Austenitic stainless grades
	%(m/m)	*%(m/m)*	*%(m/m)*
Nickel	0.40	—	—
Chromium	0.30	—	—
Molybdenum	0.15	0.30	1.00
Niobium	—	—	0.20
Titanium	—	—	0.10
Copper	—	0.30	0.70

9.3 Lead bearing steels

The basic specification shall not include lead. (See also option **A.5**.)

9.4 Product analysis and permitted deviations

NOTE Product analysis may differ from the cast analysis due to heterogeneity arising during casting and solidification. Table 6 shows the deviations from the range specified for cast analysis permitted on product analysis.

The deviation may occur either above or below the individual element ranges but shall not apply both above and below the specified range for any one element in any one cast of steel.

Test specimens for product analysis shall be taken in accordance with BS 6200-3 or BS Handbook 19.

10 Mechanical properties

NOTE 1 For through hardening steels, the mechanical properties attainable from any steel composition and heat treatment are dependent on the ruling section.

NOTE 2 The requirements in this standard show the limiting ruling section to which the stated mechanical properties apply and the purchaser should select a steel which is specified to give the desired properties in the appropriate ruling section at the time of heat treatment.

NOTE 3 Generally, specified properties are readily achievable even when bulk heat treatment is involved except where noted in Table 19 to Table 28.

NOTE 4 In Table 19 to Table 28 figures in parentheses indicate notes which appear at the end of these tables.

10.1 Tensile properties shall be as given in Table 19 to Table 28 when tested in accordance with BS EN 10002-1.

10.2 Impact properties shall be as given in Table 19 to Table 28 when tested in accordance with BS 131-1.

10.3 Hardness properties shall be as given in Table 19 to Table 28 when tested in accordance with BS 240.

Table 6 — Permitted variations of product analysis from specified range

Element	Range in which maximum of specified element falls	Variation on specified range	
		over max.	under min.
	%(m/m)	*%(m/m)*	*%(m/m)*
(a) Carbon, carbon manganese and free cutting steels			
Carbon[a]	≤ 0.25	0.02	0.02
	> 0.25 ≤ 0.50	0.03	0.03
	> 0.50 ≤ 1.05	0.04	0.04
Silicon	≤ 0.40	0.03	0.03
Manganese	≤ 1.00	0.04	0.04
	> 1.00 ≤ 1.50	0.08	0.08
	> 1.50	0.10	0.10
Phosphorus	≤ 0.025	0.005	
	> 0.025 ≤ 0.040	0.006	
	> 0.040 ≤ 0.060	0.008	
Sulfur	≤ 0.025	0.005	
	> 0.025 ≤ 0.040	0.006	
	> 0.040 ≤ 0.060	0.008	
	> 0.060 ≤ 0.10	0.010	
	> 0.10 ≤ 0.20	0.025	0.025
	> 0.20 ≤ 0.40	0.040	0.040
	When range is specified		
	0.015 to 0.040	0.006	0.003
	0.025 to 0.050	0.008	0.005
	0.050 to 0.10	0.010	0.008
Lead	0.15 to 0.35	0.03	0.02

Table 6 — Permitted variations of product analysis from specified range

Element	Range in which maximum of specified element falls	Variation on specified range	
		over max.	under min.
	%(m/m)	%(m/m)	%(m/m)
(b) Alloy steels and alloy free cutting steels			
Carbon	≤ 0.25	0.01	0.01
	> 0.25 ≤ 0.50	0.02	0.02
	> 0.50	0.03	0.03
Silicon	≤ 0.45	0.03	0.03
Manganese	≤ 0.70	0.03	0.03
	> 0.70 ≤ 1.00	0.04	0.04
	> 1.00 ≤ 2.00	0.05	0.05
Phosphorus	≤ 0.030	0.003	
	> 0.030 ≤ 0.040	0.004	
Sulfur	≤ 0.030	0.003	
	> 0.030 ≤ 0.040	0.004	
	> 0.040 ≤ 0.050	0.005	
	> 0.10 ≤ 0.20	0.025	0.025
	> 0.20 ≤ 0.40	0.04	0.04
	When range is specified		
	0.015 to 0.040	0.004	0.003
	0.025 to 0.050	0.005	0.003
Chromium	≤ 0.60	0.03	0.03
	> 0.60 ≤ 1.25	0.04	0.04
	> 1.25 ≤ 2.50	0.05	0.05
	> 2.50 ≤ 4.0	0.10	0.10
Molybdenum	≤ 0.50	0.02	0.02
	> 0.50	0.03	0.03
Nickel	≤ 1.0	0.03	0.03
	> 1.0 ≤ 3.0	0.05	0.05
	> 3.0 ≤ 5.0	0.07	0.07
Aluminium	> 0.80 ≤ 1.50	0.10	0.10
Vanadium	≤ 0.30	0.03	0.03
Lead	0.15 to 0.35	0.03	0.02

Table 6 — Permitted variations of product analysis from specified range

Element	Range in which maximum of specified element falls	Variation on specified range	
		over max.	under min.
	%(m/m)	%(m/m)	%(m/m)
(c) Stainless and heat resisting steels			
Carbon	≤ 0.03	0.005	
	> 0.03 ≤ 0.25	0.01	0.01
	> 0.25 ≤ 0.50	0.02	0.02
Silicon	≤ 1.0	0.05	0.05
	> 1.0 ≤ 2.0	0.07	0.07
Manganese	≤ 1.0	0.03	0.03
	> 1.0 ≤ 2.0	0.04	0.04
Phosphorus	≤ 0.030	0.003	
	> 0.030 ≤ 0.045	0.004	
	> 0.045	0.005	
Sulfur	≤ 0.030	0.003	
	> 0.030 ≤ 0.080	0.005	
	Specified range		
	0.15 to 0.35	0.02	0.02
Chromium	≤ 10.0	0.10	0.10
	> 10.0 ≤ 15.0	0.15	0.15
	> 15.0 ≤ 20.0	0.20	0.20
	> 20.0	0.25	0.25
Molybdenum	≤ 1.0	0.03	0.03
	> 1.0 ≤ 2.0	0.05	0.05
	> 2.0 ≤ 3.0	0.08	0.08
Nickel	≤ 1.0	0.03	0.03
	> 1.0 ≤ 3.0	0.05	0.05
	> 3.0 ≤ 5.0	0.07	0.07
	> 5.0 ≤ 10.0	0.10	0.10
	> 10.0 ≤ 20.0	0.15	0.15
	> 20.0	0.20	0.20
Niobium	All ranges	0.05	0.05
Selenium	All ranges	0.03	0.03
Titanium	All ranges	0.05	0.05

[a] When required by the purchaser and subject to agreement with the supplier, smaller variations for the carbon range over 0.25 % up to and including 0.50 % may be agreed.

10.4 The 19 mm test piece size shall be used. (See also **3.3** e).)

NOTE 1 For carbon and carbon manganese case hardening steels, it is customary to test and release steel to specified mechanical property levels using a standard size of test piece. However, because of the effect of section size, the properties are quoted for different test piece sizes in the oil-quenched condition, i.e. 13 mm, 19 mm and 29 mm, but the 19 mm test piece is to be used unless otherwise agreed.

NOTE 2 The properties specified for both carbon and alloy steels apply only to the test piece size used and the heat treatment specified. If other heat treatments and/or sizes of test piece are used, then different results may be obtained. The conditions for these heat treatments and tests should be agreed between the purchaser and the supplier.

NOTE 3 The properties obtained are representative of those bars heat treated in the same ruling section as that of the test piece and may not represent larger ruling sections.

11 Retests

11.1 General

Retests shall be carried out as specified in **11.2** to **11.4**. If any test sample or test piece fails to comply with the specified requirements as a result of incorrect application of the test procedure or faulty equipment, the test results shall be discarded and a further test sample(s) shall be retested.

11.2 Tensile tests

11.2.1 Should any of the original test pieces fail, twice the original number of test samples shall be selected for retesting, one of which shall be taken from the bar from which the original test sample was taken, unless that item has been withdrawn by the manufacturer.

11.2.2 The mechanical properties obtained from the test pieces prepared from the further test samples shall comply with the specified requirements. Should any of the retests fail, the material represented shall be deemed not to comply with this standard.

11.2.3 In the case of material supplied in the heat treated condition, the manufacturer shall have the right to re-heat treat the material and resubmit it for retesting.

11.2.4 In the case of dispute with the reported yield stress the 0.5 % proof stress (total elongation) shall be used.

11.3 Impact test

11.3.1 If the average of three impact values is lower than the specified value, or if any one value is lower than 70 % of this specified value, three additional test pieces shall be taken from the same sample and tested. The average value of the six tests shall be not less than the specified value. Not more than two of the individual values shall be lower than the specified value and not more than one shall be lower than 70 % of this value.

11.3.2 In the case of material supplied in the heat treated condition, the manufacturer shall have the right to re-heat treat the material and resubmit it for retesting.

11.4 Hardness test

11.4.1 Should the hardness value determined on any bar fail to comply with the specified requirements, then three additional test samples of items shall be selected for retesting, one of which shall be from the original bar unless that item has been withdrawn by the manufacturer.

12 Freedom from defects

12.1 Internal soundness

The procedures for casting, hot-working, re-heating and cooling shall ensure that the product is free from piping, central unsoundness and harmful segregation.

NOTE Where assurance is required see also **3.3** j).

12.2 Cleanness

If specific levels of cleanness are required, they shall be in accordance with the standards specified in the enquiry and/or order, see **3.3** k).

NOTE Sulfide inclusions and segregation lines which are intrinsic to free-cutting steels are not to be regarded as a defect in the material.

12.3 Surface condition

12.3.1 *Cold drawn bar and cold drawn and ground bar*

12.3.1.1 Surface defects shall not exceed the maximum values given in Table 7 to Table 11, in bars supplied in the cold drawn and cold drawn and ground condition.

Table 7 — Rounds, squares and hexagons in sizes from 10 mm up to and including 100 mm diameter or across flat: maximum permissible surface defects

Steel type	Maximum permissible defect depth as percentage of section
	%
Balanced free-cutting	2.00
Killed free-cutting	1.25
Killed carbon	1.00
Killed coarse grain	2.00
Hot or cold forging	0.75
Low alloy and stainless	0.75

12.3.1.2 The minimum rejectable defect depth for balanced free-cutting, killed free-cutting, killed carbon and killed coarse grain steels shall be 0.25 mm irrespective of section, and for hot or cold forging and low alloy and stainless steels it shall be 0.20 mm.

Table 8 — Flats greater than 105 mm wide in free-cutting, semi-free-cutting and carbon steels: maximum permissible surface defects

Thickness	Maximum permissible defect depth on the wider or flat faces	
	Widths > 105 mm to ≤ 160 mm	Widths > 160 mm
mm	mm	mm
> 3 ≤ 10	0.20	0.20
> 10 ≤ 18	0.25	0.25
> 18 ≤ 30	0.30	0.45
> 30 ≤ 50	0.50	0.80
> 50 ≤ 80	0.70	1.00
> 80 ≤ 105	0.80	1.00
> 105	1.00	1.00

12.3.1.3 The maximum permissible defect depth on the surfaces of the narrower or edge faces of flats in qualities and sizes covered by Table 8 shall be 1 mm.

Table 9 — Flats greater than 105 mm wide in hot and cold forging steels and low alloy steels: maximum permissible defect depths

Thickness	Maximum permissible defect depth on the wider or flat faces
mm	mm
> 3 ≤ 10	0.10
> 10 ≤ 18	0.15
> 18 ≤ 30	0.20
> 30 ≤ 50	0.30
> 50 ≤ 80	0.50
> 80	0.70
NOTE The defect is to be measured perpendicular to the bar surface.	

12.3.1.4 The maximum permissible defect depth on the surface of the narrower or edge face of flats in qualities and sizes covered by Table 9 shall be 0.7 min.

NOTE Where specific assurance of maximum defect levels is required materials can be supplied crack detected. (See also **3.3** j).)

12.3.2 *Turned bar and turned and ground bar*

The stock removal during the manufacture of bars to be supplied in the turned or turned and ground condition, shall be sufficient to ensure freedom from surface defects of steel making or hot rolling origin.

12.4 Decarburization

Turned or turned and ground bars shall be free from decarburization.

NOTE For bars produced by drawing see also **3.3** l).

13 Marking

Unless otherwise specified at the time of enquiry and/or order bars shall be supplied labelled but unmarked.(See **3.3** m).)

Table 10 — Flats equal to or less than 105 mm wide in free-cutting, semi-free-cutting and carbon steels: maximum permissible defect depths

Thickness	Maximum permissible defect depths				
	Wider or flat face	Narrower or edge face			
		Widths			
		≤ 30 mm	> 30 mm ≤ 50 mm	> 50 mm ≤ 80 mm	> 80 mm ≤ 105 mm
mm	mm	mm	mm	mm	mm
> 3 ≤ 10	0.2	0.40	0.65	0.80	1.00
> 10 ≤ 18	0.3				
> 18 ≤ 30	0.4				
> 30 ≤ 50	0.6				
> 50 ≤ 80	0.7				

NOTE The defect is to be measured perpendicular to the bar surface.

Table 11 — Flats equal to or less than 105 mm wide in hot and cold forging steels, and alloy steels: maximum permissible defect depths

Thickness	Maximum permissible defect depths				
	Wider or flat face	Narrower or edge face			
		Widths			
		≤ 30 mm	> 30 mm ≤ 50 mm	> 50 mm ≤ 80 mm	> 80 mm ≤ 105 mm
mm	mm	mm	mm	mm	mm
> 3 ≤ 10	0.15	0.20	0.30	0.50	0.70
> 10 ≤ 18	0.15				
> 18 ≤ 30	0.20				
> 30 ≤ 50	0.30				
> 50 ≤ 80	0.50				

NOTE The defect is to be measured perpendicular to the bar surface.

Table 12 — Chemical composition: free-cutting steels

Steel	C	Si	Mn	P	S
	%(m/m)	*%(m/m)*	*%(m/m)*	*%(m/m)*	*%(m/m)*
230M07	0.15 max.	0.05 max.	0.90 to 1.30	0.090 max.	0.25 to 0.35
216M36	0.32 to 0.40	0.25 max.	1.30 to 1.70	0.06 max.	0.12 to 0.20
212A42	0.40 to 0.45	0.25 max.	1.00 to 1.30	0.06 max.	0.12 to 0.20
226M44	0.40 to 0.48	0.25 max.	1.30 to 1.70	0.06 max.	0.22 to 0.30

Table 13 — Chemical composition: carbon and carbon manganese steels

Steel	C	Si	Mn	P	S
	%(m/m)	*%(m/m)*	*%(m/m)*	*%(m/m)*	*%(m/m)*
080A15	0.13 to 0.18	0.10 to 0.40	0.70 to 0.90	0.05 max.	0.05 max.
080M15	0.12 to 0.18	0.10 to 0.40	0.60 to 1.00	0.05 max.	0.05 max.
070M20	0.16 to 0.24	0.10 to 0.40	0.50 to 0.90	0.05 max.	0.05 max.
080A30	0.26 to 0.34	0.10 to 0.40	0.70 to 0.90	0.05 max.	0.05 max.
080M30	0.26 to 0.34	0.10 to 0.40	0.60 to 1.00	0.05 max.	0.05 max.
080M40	0.36 to 0.44	0.10 to 0.40	0.60 to 1.00	0.05 max.	0.05 max.
080A42	0.40 to 0.45	0.10 to 0.40	0.70 to 0.90	0.05 max.	0.05 max.
080A47	0.45 to 0.50	0.10 to 0.40	0.70 to 0.90	0.05 max.	0.05 max.
080M50	0.45 to 0.55	0.10 to 0.40	0.60 to 1.00	0.05 max.	0.05 max.
070M55	0.50 to 0.60	0.10 to 0.40	0.50 to 0.90	0.05 max.	0.05 max.
150M19	0.15 to 0.23	0.10 to 0.40	1.30 to 1.70	0.05 max.	0.05 max.
150M36	0.32 to 0.40	0.10 to 0.40	1.30 to 1.70	0.05 max.	0.05 max.

NOTE See also **3.3** g) and option **A.1**, **A.2** and **A.4**.

Table 14 — Chemical composition: case hardening steels (carbon and carbon manganese steels)

Steel	C	Si	Mn	P	S
	%(m/m)	*%(m/m)*	*%(m/m)*	*%(m/m)*	*%(m/m)*
045A10	0.08 to 0.13	0.10 to 0.40	0.30 to 0.60	0.05 max.	0.05 max.
045M10	0.07 to 0.13	0.10 to 0.40	0.30 to 0.60	0.05 max.	0.05 max.
080M15	0.12 to 0.18	0.10 to 0.40	0.60 to 1.00	0.05 max.	0.05 max.
210M15	0.12 to 0.18	0.10 to 0.40	0.90 to 1.30	0.05 max.	0.10 to 0.18

Table 15 — Chemical composition: alloy case hardening Steels[a]

Steel	C	Si	Mn	Cr	Mo	Ni
	%(m/m)	*%(m/m)*	*%(m/m)*	*%(m/m)*	*%(m/m)*	*%(m/m)*
635M15	0.12 to 0.18	0.10 to 0.40	0.60 to 0.90	0.4 to 0.80	—	0.70 to 1.10
637M17	0.14 to 0.20	0.10 to 0.40	0.60 to 0.90	0.60 to 1.00	—	0.85 to 1.25
655M13	0.10 to 0.16	0.10 to 0.40	0.35 to 0.60	0.70 to 1.00	—	3.00 to 3.75
665M17	0.14 to 0.20	0.10 to 0.40	0.35 to 0.75	—	0.20 to 0.30	1.50 to 2.00
805M17	0.14 to 0.20	0.10 to 0.40	0.60 to 0.95	0.35 to 0.65	0.15 to 0.25	0.35 to 0.75
805M20	0.17 to 0.23	0.10 to 0.40	0.60 to 0.95	0.35 to 0.65	0.15 to 0.25	0.35 to 0.75
815M17	0.14 to 0.20	0.10 to 0.40	0.60 to 0.90	0.80 to 1.20	0.10 to 0.20	1.20 to 1.70
820M17	0.14 to 0.20	0.10 to 0.40	0.60 to 0.90	0.80 to 1.20	0.10 to 0.20	1.50 to 2.00
822M17	0.14 to 0.20	0.10 to 0.40	0.40 to 0.70	1.30 to 1.70	0.15 to 0.25	1.75 to 2.25
835M15	0.12 to 0.18	0.10 to 0.40	0.25 to 0.50	1.00 to 1.40	0.15 to 0.30	3.90 to 4.30

NOTE See also **3.3** c), **3.3** i) and options **A.2** and **A.5**.

[a] Sulfur 0.05 % max., phosphorous 0.04 % max. for all qualities.

Table 16 — Chemical composition: alloy direct hardening steels

Steel	C	Si	Mn	P	S	Cr	Mo	Ni
	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)
530M40	0.36 to 0.44	0.10 to 0.40	0.60 to 0.90	0.035 max.	0.040 max.	0.90 to 1.20	—	—
605M36	0.32 to 0.40	0.10 to 0.40	1.30 to 1.70	0.035 max.	0.040 max.	—	0.22 to 0.32	—
606M36	0.32 to 0.40	0.10 to 0.40	1.30 to 1.70	0.035 max.	0.15 to 0.25	—	0.22 to 0.32	—
708M40	0.36 to 0.44	0.10 to 0.40	0.70 to 1.00	0.035 max.	0.040 max.	0.90 to 1.20	0.15 to 0.25	—
709M40	0.36 to 0.44	0.10 to 0.40	0.70 to 1.00	0.035 max.	0.040 max.	0.90 to 1.20	0.25 to 0.35	—
722M24	0.20 to 0.28	0.10 to 0.40	0.45 to 0.70	0.035 max.	0.040 max.	3.00 to 3.50	0.45 to 0.65	—
817M40	0.36 to 0.44	0.10 to 0.40	0.45 to 0.70	0.035 max.	0.040 max.	1.00 to 1.40	0.20 to 0.35	1.30 to 1.70
826M31	0.27 to 0.35	0.10 to 0.40	0.45 to 0.70	0.035 max.	0.040 max.	0.50 to 0.80	0.45 to 0.65	2.30 to 2.80
826M40	0.36 to 0.44	0.10 to 0.40	0.45 to 0.70	0.035 max.	0.040 max.	0.50 to 0.80	0.45 to 0.65	2.30 to 2.80
945M38	0.34 to 0.42	0.10 to 0.40	1.20 to 1.60	0.035 max.	0.040 max.	0.40 to 0.60	0.15 to 0.25	0.60 to 0.90

NOTE See also **3.3** c), **3.3** i) and options **A.2** and **A.5**.

Table 17 — Chemical composition: ferritic and martensitic stainless and heat resisting steels

Steel	Chemical composition (maximum unless range stated)								
	C	Si	Mn	P	S	Cr	Mo	Ni	Se
Ferritic steels									
	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)	%(*m*/*m*)
403S17	0.08	1.0	1.0	0.040	0.030	12.0 to 14.0	—	0.50	—
430S17	0.08	1.0	1.0	0.040	0.030	16.0 to 18.0	—	0.50	—
Martensitic steels									
410S21	0.09 to 0.15	1.0	1.0	0.040	0.030	11.5 to 13.5	—	1.00	—
416S21	0.09 to 0.15	1.0	1.5	0.060	0.15 to 0.35	11.5 to 13.5	0.60	1.00	—
416S29	0.14 to 0.20	1.0	1.5	0.060	0.15 to 0.35	11.5 to 13.5	0.60	1.00	—
416S37	0.20 to 0.28	1.0	1.5	0.060	0.15 to 0.35	12.0 to 14.0	0.60	1.00	—
416S41	0.09 to 0.15	1.0	1.5	0.060	0.060	11.5 to 13.5	0.60	1.00	0.15 to 0.35
420S29	0.14 to 0.20	1.0	1.0	0.040	0.030	11.5 to 13.5	—	1.00	—
420S37	0.20 to 0.28	1.0	1.0	0.040	0.030	12.0 to 14.0	—	1.00	—
431S29	0.12 to 0.20	1.0	1.0	0.040	0.030	15.0 to 18.0	—	2.0 to 3.0	—

Table 18 — Chemical composition: austenitic stainless and heat resisting steels

Steel	Chemical composition (maximum unless range stated)								
	C	Si	Mn	P	S	Cr	Mo	Ni	Others
Austenitic steels									
	%(m/m)	%(m/m)	%(m/m)	%(m/m)	%(m/m)	%(m/m)	%(m/m)	%(m/m)	%(m/m)
302S31	0.12	1.0	2.0	0.045	0.030	17.0 to 19.0	—	8.0 to 10.0	—
304S11	0.030	1.0	2.0	0.045	0.030	17.0 to 19.0	—	9.0 to 12.0	—
304S15	0.06	1.0	2.0	0.045	0.030	17.5 to 19.0	—	8.0 to 11.0	—
304S31	0.07	1.0	2.0	0.045	0.030	17.0 to 19.0	—	8.0 to 11.0	—
321S31	0.08	1.0	2.0	0.045	0.030	17.0 to 19.0	—	9.0 to 12.0	Ti 5C max. 0.80
347S31	0.08	1.0	2.0	0.045	0.030	17.0 to 19.0	—	9.0 to 12.0	Nb 10C max. 1.00
316S11	0.030	1.0	2.0	0.045	0.030	16.5 to 18.5	2.00 to 2.50	11.0 to 14.0	—
316S13	0.030	1.0	2.0	0.045	0.030	16.5 to 18.5	2.50 to 3.00	11.5 to 14.5	—
316S31	0.07	1.0	2.0	0.045	0.030	16.5 to 18.5	2.00 to 2.50	10.5 to 13.5	—
316S33	0.07	1.0	2.0	0.045	0.030	16.5 to 18.5	2.50 to 3.00	11.0 to 14.0	—
320S31	0.08	1.0	2.0	0.045	0.030	16.5 to 18.5	2.00 to 2.50	11.0 to 14.0	Ti 5C max. 0.80
310S31	0.15	1.5	2.0	0.045	0.030	24.0 to 26.0	—	19.0 to 22.0	—
303S31	0.12	1.0	2.0	0.060	0.15 to 0.35	17.0 to 19.0	1.00 (9)	8.0 to 10.0	—
303S42	0.12	1.0	2.0	0.060	0.060	17.0 to 19.0	1.00 (9)	8.0 to 10.0	Se 0.15 to 0.35
325S31	0.12	1.0	2.0	0.045	0.15 to 0.35	17.0 to 19.0	—	8.0 to 11.0	Ti 5C max. 0.90

Table 19 — Mechanical properties for free-cutting steels (18)

Steel	Condition (2)	Size (1) (diameter across flats or thickness)	R_m	R_e min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
230M07	Hot rolled + turned or ground	≥ 6 < 100	360 min.	215	22	—	—	—	103 min.
	Hot rolled + cold drawn or hot rolled + cold drawn + ground	≥ 6 ≤ 13	480 min.	400	6	—	—	360	—
		> 13 ≤ 16	460 min.	380	7	—	—	345	—
		> 16 ≤ 40	430 min.	340	8	—	—	300	—
		> 40 ≤ 63	390 min.	280	9	—	—	240	—
		> 63 ≤ 76	370 min.	240	10	—	—	225	—
216M36	Hot rolled + cold drawn or hot rolled + cold drawn + ground	≥ 6 < 13	680 min.	530	6	—	—	510	—
		> 13 ≤ 16	650 min.	510	7	—	—	487	—
		> 16 ≤ 40	620 min.	480	7	—	—	434	—
		> 40 ≤ 63	600 min.	460	8	—	—	372	—
		> 63 ≤ 76	570 min.	420	9	—	—	353	—
	Hardened and tempered + turned or ground	*P* ≥ 6 < 100	550 to 700	340	20	34	28	310	152 to 207
		Q > 6 ≤ 63	625 to 775	400	18	34	28	370	179 to 229
		R > 6 ≤ 29	700 to 850	480	16	34	28	450	201 to 255
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	*P* ≥ 29 < 100	550 to 700	380	15	34	—	340	152 to 207
		Q > 13 ≤ 63	625 to 775	440	13	34	—	400	179 to 229
		R > 6 ≤ 29	700 to 850	520	12	34	—	470	201 to 255
226M44	Hardened and tempered + turned or ground (1)	*R* ≥ 6 < 100	700 to 850	450	16	27	22	415	201 to 255
		S > 6 ≤ 29	775 to 925	525	14	20	16	495	223 to 277
		T > 6 ≤ 13	850 to 1 000	600	12	20	16	585	248 to 302
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground (4)	*R* ≥ 6 to < 100	700 to 850	525	12	27	—	435	201 to 255
		S > 6 to ≤ 29	775 to 925	575	10	20	—	520	223 to 277
		T > 6 to ≤ 13	850 to 1 000	630	9	20	—	600	248 to 302

[a] See also option **A.3**.

Table 20 — Mechanical properties for carbon and carbon manganese steels (18)

Steel	Condition (2)	Size (1) (diameter across flats or thickness)	R_m	R_e min.	A min. on $5.65\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
080M15	Normalized + turned or ground	≥ 6 ≤ 63	350 min.	175	22	—	—	—	109 to 163
		> 63 ≤ 150	330 min.	165	22	—	—	—	101 to 152
	Hot rolled + cold drawn or hot rolled + cold drawn + ground	≥ 6 ≤ 13	450 min.	330	10				
		> 13 ≤ 29	430 min.	320	12				
		> 29 ≤ 100	400 min.	300	13				
070M20	Normalized + turned or ground	≥ 6 ≤ 150	430 min.	215	21	—	—	—	126 to 179
		> 150 ≤ 250	400 min.	200	21	—	—	—	116 to 170
	Hot rolled + cold drawn or hot rolled + cold drawn + ground	≥ 6 ≤ 13	560 min.	440	10	—	—	420	—
		> 13 ≤ 16	530 min.	420	12	—	—	390	—
		> 16 ≤ 40	490 min.	370	12	—	—	340	—
		> 40 ≤ 63	480 min.	355	13	—	—	290	—
		> 63 ≤ 76	450 min.	325	14	—	—	280	—
080M30	Normalized + turned or ground	≥ 6 ≤ 150	490 min.	245	20	—	—	—	143 to 192
		> 150 ≤ 250	460 min.	230	19	—	—	—	134 to 183
	Hot rolled + cold drawn or hot rolled + cold drawn + ground	≥ 6 ≤ 13	620 min.	480	9	—	—	460	
		> 13 ≤ 16	600 min.	470	10	—	—	450	
		> 16 ≤ 40	570 min.	430	11	—	—	400	
		> 40 ≤ 63	560 min.	415	12	—	—	345	
		> 63 ≤ 76	530 min.	385	12	—	—	320	
	Hardened and tempered + turned or ground	P ≥ 6 ≤ 63	550 to 700	340	18	34	28	310	152 to 207
		Q ≥ 6 ≤ 19	625 to 775	415	16	34	28	400	179 to 229
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	P ≥ 6 ≤ 63	550 to 700	385	13	34	—	340	152 to 207
		Q ≥ 6 ≤ 19	625 to 775	460	12	34	—	430	179 to 229

[a] See also option **A.3**.

Table 20 — Mechanical properties for carbon and carbon manganese steels (18)

Steel	Condition (2)	Size (1) (diameter across flats or thickness)	R_m	R_e min.	A min. on $5.65\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
080M40	Normalized + turned or ground	≥ 6 ≤ 150	550 min.	280	16	20	16	—	152 to 207
		> 150 ≤ 250	510 min.	245	17	—	—	—	146 to 197
	Hot rolled + cold drawn or hot rolled + cold drawn + ground	≥ 6 ≤ 13	660 min.	530	7	—	—	495	
		> 13 ≤ 16	650 min.	510	8	—	—	485	
		> 16 ≤ 40	620 min.	480	9	—	—	435	
		> 40 ≤ 63	600 min.	465	10	—	—	370	
		> 63 ≤ 76	570 min.	430	10	—	—	350	
	Hardened and tempered + turned or ground	Q ≥ 6 ≤ 63	625 to 775	385	16	34	28	355	179 to 229
		R ≥ 6 ≤ 19	700 to 850	465	16	34	28	450	201 to 255
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	Q ≥ 6 ≤ 63	625 to 775	435	12	34	—	380	179 to 229
		R ≥ 6 ≤ 19	700 to 850	490	12	34	—	460	201 to 255
080M50	Normalized + turned or ground	≥ 6 ≤ 150	620 min.	310	14	—	—	—	179 to 229
		> 150 ≤ 250	570 min.	295	14	—	—	—	163 to 217
	Normalized + cold drawn or normalized + cold drawn + ground	≥ 6 ≤ 13	740 min.	590	7	—	—	555	
		> 13 ≤ 16	730 min.	585	8	—	—	545	
		> 16 ≤ 40	690 min.	555	8	—	—	485	
		> 40 ≤ 63	680 min.	540	9	—	—	420	
		> 63 ≤ 76	650 min.	510	10	—	—	400	
	Hardened and tempered + turned or ground (4)	Q ≥ 6 ≤ 150	625 to 775	390	15	—	—	360	179 to 229
		R ≥ 6 ≤ 63	700 to 850	430	14	—	—	400	201 to 255
		S ≥ 6 ≤ 29	775 to 925	495	14	—	—	465	223 to 277
		T ≥ 6 ≤ 13	850 to 1 000	570	12	—	—	555	248 to 302
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground (4)	Q ≥ 13 ≤ 150	625 to 775	430	11	—	—	390	179 to 229
		R ≥ 6 ≤ 63	700 to 850	490	10	—	—	450	201 to 255
		S ≥ 6 ≤ 29	775 to 925	540	10	—	—	500	223 to 277
		T ≥ 6 ≤ 13	850 to 1 000	595	9	—	—	550	248 to 302
	Turned, ground or cold drawn and finally softened	—	—	—	—	—	—	—	187 max.

[a] See also option **A.3**.

Table 20 — Mechanical properties for carbon and carbon manganese steels (18)

Steel	Condition (2)	Size (1) (diameter across flats or thickness)	R_m	R_e min.	A min. on $5.65\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
070M55	Normalized + turned or ground	≥ 6 ≤ 63	700 min.	355	12	—	—	—	201 to 255
		> 63 ≤ 250	600 min.	310	13		—	—	170 to 223
	Normalized + cold drawn or normalized + cold drawn + ground	≥ 6 ≤ 13	760 min.	610	6	—	—	570	
		> 13 ≤ 16	750 min.	600	7	—	—	560	
		> 16 ≤ 40	710 min.	575	7	—	—	495	
		> 40 ≤ 63	700 min.	545	8	—	—	440	
		> 63 ≤ 76	670 min.	530	9	—	—	420	
	Hardened and tempered + turned or ground (4)	R > 13 ≤ 100	700 to 850	415	14	—	—	385	201 to 255
		S ≥ 6 ≤ 63	775 to 925	480	14	—	—	450	223 to 277
		T ≥ 6 ≤ 19	850 to 1 000	570	12	—	—	555	248 to 302
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground (4)	R > 29 ≤ 100	700 to 850	475	10	—	—	435	201 to 255
		R > 13 ≤ 29	700 to 850	510	10	—	—	475	201 to 255
		S ≥ 6 ≤ 63	775 to 925	525	10	—	—	485	223 to 277
		T > 6 ≤ 19	850 to 1 000	595	9	—	—	550	248 to 302
	Turned, ground or cold drawn and finally softened	—	—	—	—	—	—	—	201 max.
150M19	Normalized + turned or ground	≥ 6 ≤ 150	550 min.	325	18	40	35	—	152 to 207
		> 150 ≤ 250	510 min.	295	17	—	—	—	146 to 197
	Hardened and tempered + turned or ground	P > 13 ≤ 150	550 to 700	340	18	54	50	325	152 to 207
		Q ≥ 6 ≤ 63	625 to 775	430	16	54	50	415	179 to 229
		R ≥ 6 ≤ 29	700 to 850	510	16	40	35	495	201 to 255
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	P > 19 ≤ 150	550 to 700	360	13	54	—	345	152 to 207
		Q ≥ 6 ≤ 63	625 to 775	450	12	54	—	435	179 to 229
		R ≥ 6 ≤ 29	700 to 850	520	12	40	—	510	201 to 255
150M36	Normalized + turned or ground	≥ 6 ≤ 150	620 min.	385	14	—	—	—	179 to 229
		> 150 ≤ 250	600 min.	355	15	—	—	—	170 to 223
	Hardened and tempered + turned or ground (4)	Q > 19 ≤ 150	625 to 775	400	18	47	42	370	179 to 229
		R > 13 ≤ 63	700 to 850	480	16	41	35	450	201 to 255
		S ≥ 6 ≤ 29	775 to 925	555	14	41	35	525	223 to 277
		T ≥ 6 ≤ 13	850 to 1 000	635	12	34	28	620	248 to 302
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground (4)	Q > 19 ≤ 150	625 to 775	440	13	47	—	400	179 to 229
		R > 13 ≤ 63	700 to 850	520	12	41	—	480	201 to 255
		S ≥ 6 ≤ 29	775 to 925	580	10	41	—	540	223 to 277
		T ≥ 6 ≤ 13	850 to 1 000	665	9	34	—	635	248 to 302

[a] See also option **A.3**.

Table 21 — Mechanical properties for alloy steels (18)

Steel	Condition (2)	Size (1) (diameter across flats, or thickness)	R_m	R_e min.	A min. on $5.65\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
530M40	Hardened and tempered + turned or ground	R > 63 ≤ 100	700 to 850	525	17	54	50	510	201 to 255
		S ≥ 6 ≤ 63	775 to 925	585	15	54	50	570	223 to 277
		T ≥ 6 ≤ 29	850 to 1 000	680	13	54	50	665	248 to 302
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	R > 63 ≤ 100	700 to 850	540	12	54	—	525	201 to 255
		S > 13 ≤ 63	775 to 925	600	11	54	—	585	223 to 277
		T ≥ 6 ≤ 29	850 to 1 000	700	9	54	—	680	248 to 302
	Turned, ground or cold drawn and finally softened								229 max.
605M36	Hardened and tempered + turned or ground	R >150 ≤ 250	700 to 850	495	15	34	28	480	201 to 255
		R > 29 ≤ 150	700 to 850	525	17	54	50	510	201 to 255
		S > 13 ≤ 100	775 to 925	585	15	54	50	570	223 to 277
		T ≥ 6 ≤ 63	850 to 1 000	680	13	54	50	665	248 to 302
		U ≥ 6 ≤ 29	925 to 1 075	755	12	47	42	740	269 to 331
		V ≥ 6 ≤ 19	1 000 to 1 150	850	12	47	42	835	293 to 352
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	R > 29 ≤ 150	700 to 850	540	12	54	—	525	201 to 255
		S > 13 ≤ 100	775 to 925	600	11	54	—	585	223 to 277
		T ≥ 6 ≤ 63	850 to 1 000	700	9	54	—	680	248 to 302
		U ≥ 6 ≤ 29	925 to 1 075	770	9	47	—	755	269 to 331
		V ≥ 6 ≤ 19	1 000 to 1 150	865	9	47	—	850	293 to 352
	Turned, ground or cold drawn and finally softened								241 max.
606M36	Hardened and tempered + turned or ground	R > 13 ≤ 100	700 to 850	525	15	54	50	510	201 to 255
		S ≥ 6 ≤ 63	775 to 925	585	13	47	42	570	223 to 277
		T ≥ 6 ≤ 29	850 to 1 000	680	11	40	35	665	248 to 302
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	R > 29 ≤ 100	700 to 850	540	11	47	—	525	201 to 255
		S ≥ 6 ≤ 63	775 to 925	600	10	47	—	585	223 to 277
		T ≥ 6 ≤ 29	850 to 1 000	700	8	40	—	680	248 to 302
	Turned, ground or cold drawn and finally softened								229 max.

[a] See also option **A.3**.

Table 21 — Mechanical properties for alloy steels (18)

Steel	Condition (2)	Size (1) (diameter across flats, or thickness)	R_m	R_e min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
708M40	Hardened and tempered + turned or ground	$R > 150 \leq 250$	700 to 850	495	15	34	28	480	201 to 255
		$R > 63 \leq 150$	700 to 850	525	17	54	50	510	201 to 255
		$S > 29 \leq 100$	775 to 925	585	15	54	50	570	223 to 277
		$T \geq 6 \leq 63$	850 to 1 000	680	13	54	50	665	248 to 302
		$U \geq 6 \leq 29$	925 to 1 075	755	12	47	42	740	269 to 331
		$V \geq 6 \leq 19$	1 000 to 1 150	850	12	47	42	835	293 to 352
	(4)(6)	$W \geq 6 \leq 13$	1 075 to 1 225	940	12	40	35	925	311 to 375
	Hardened and tempered + cold drawn or hardened + tempered + cold drawn + ground	$R > 63 \leq 150$	700 to 850	540	12	54	—	525	201 to 255
		$S > 29 \leq 100$	775 to 925	600	11	54	—	585	223 to 277
		$T \geq 6 \leq 63$	850 to 1 000	700	9	54	—	680	248 to 302
		$U \geq 6 \leq 29$	925 to 1 075	770	9	47	—	755	269 to 331
		$V \geq 6 \leq 19$	1 000 to 1 150	865	9	47	—	850	293 to 352
	(4)(6)	$W \geq 6 \leq 13$	1 075 to 1 225	955	8	40		940	311 to 375
	Turned, ground or cold drawn and finally softened								248 max.
709M40	Hardened and tempered + turned or ground	$R > 100 \leq 250$	700 to 850	495	15	34	28	480	201 to 255
		$S > 150 \leq 250$	775 to 925	555	13	27	22	540	223 to 277
		$S > 63 \leq 150$	775 to 925	585	15	54	50	570	223 to 277
		$T > 29 \leq 100$	850 to 1 000	680	13	54	50	665	248 to 302
		$U > 13 \leq 63$	925 to 1 075	755	12	47	42	740	269 to 331
	(4)(6)	$V \geq 6 \leq 29$	1 000 to 1 150	850	12	47	42	835	293 to 352
	(6)	$W \geq 6 \leq 19$	1 075 to 1 225	940	12	40	35	925	311 to 375
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	$R > 100 \leq 150$	700 to 850	540	11	54	—	510	201 to 255
		$S > 63 \leq 150$	775 to 925	600	11	54	—	585	223 to 277
		$T > 29 \leq 100$	850 to 1 000	700	9	54	—	680	248 to 302
		$U > 13 \leq 63$	925 to 1 075	770	9	47	—	755	269 to 331
	(4)(6)	$V \geq 6 \leq 29$	1 000 to 1 150	865	9	47	—	850	293 to 352
		$W \geq 6 \leq 19$	1 075 to 1 225	955	8	40	—	940	311 to 375
	Turned, ground or cold drawn and finally softened								255 max.

[a] See also option **A.3**.

Table 21 — Mechanical properties for alloy steels (18)

Steel	Condition (2)	Size (1) (diameter across flats, or thickness)	R_m	R_e min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
722M24	Hardened and tempered + turned or ground	$T > 150 \leq 250$	850 to 1 000	650	13	40	35	635	248 to 302
		$T \geq 6 \leq 150$	850 to 1 000	680	13	54	50	665	248 to 302
		$U \geq 6 \leq 150$	925 to 1 075	755	12	47	42	740	269 to 331
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	$T \geq 6 \leq 150$	850 to 1 000	700	9	54	—	680	248 to 302
		$U \geq 6 \leq 150$	925 to 1 075	770	9	47	—	755	269 to 331
	Turned, ground or cold drawn and finally softened								269 max.
817M40	Hardened and tempered + turned or ground	$T > 150 \leq 250$	850 to 1 000	650	13	40	35	635	248 to 302
		$T > 63 \leq 150$	850 to 1 000	680	13	54	50	665	248 to 302
		$U > 29 \leq 100$	925 to 1 075	755	12	47	42	740	269 to 331
		$V > 13 \leq 63$	1 000 to 1 150	850	12	47	42	835	293 to 352
	(6)	$W \geq 6 \leq 29$	1 075 to 1 225	940	11	40	35	925	311 to 375
	(1)(6)	$X \geq 6 \leq 29$	1 150 to 1 300	1 020	10	34	28	1 005	341 to 401
	(1)(6)	$Z \geq 6 \leq 29$	1 550 min.	1 235	5	10	9	1 125	444 min.
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	$T > 63 \leq 150$	850 to 1 000	700	9	54	—	680	248 to 302
		$U > 29 \leq 100$	925 to 1 075	770	9	47	—	755	269 to 331
		$V > 13 \leq 63$	1 000 to 1 150	865	9	47	—	850	293 to 352
	(4)(6)(7)	$W \geq 6 \leq 29$	1 075 to 1 225	955	8	40	—	940	311 to 375
	(4)(6)(7)	$X \geq 6 \leq 29$	1 150 to 1 300	1 035	7	34	—	1 020	341 to 401
	(4)(6)(7)	$Z \geq 6 \leq 29$	1 550 min.	1 250	3	11	—	1 235	444 min.
	Turned, ground or cold drawn and finally softened								277 max.

[a] See also option **A.3**.

Table 21 — Mechanical properties for alloy steels (18)

Steel	Condition (2)	Size (1) (diameter across flats, or thickness)	R_m	R_e min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
826M31	Hardened and tempered and turned or ground	$T > 150 \leq 250$	850 to 1 000	650	13	40	35	635	248 to 302
		$T > 100 \leq 150$	850 to 1 000	680	13	54	50	665	248 to 302
		$U > 150 \leq 250$	925 to 1 075	740	12	34	28	725	269 to 331
		$U > 100 \leq 150$	925 to 1 075	755	12	47	42	740	269 to 331
		$V > 63 \leq 150$	1 000 to 1 150	850	12	47	42	835	293 to 352
	(6)	$W > 29 \leq 100$	1 075 to 1 225	940	11	40	35	925	311 to 375
	(6)	$X > 13 \leq 63$	1 150 to 1 300	1 020	10	34	28	1 005	341 to 401
	(6)	$Z > 13 \leq 63$	1 550 min.	1 235	5	10	9	1 125	444 min.
	Hardened and tempered and cold drawn or hardened and tempered and cold drawn and ground	$T > 63 \leq 150$	850 to 1 000	700	9	54	—	680	248 to 302
		$U > 29 \leq 100$	925 to 1 075	770	9	47	—	755	269 to 331
		$V > 29 \leq 100$	1 000 to 1 150	885	9	47	—	850	293 to 362
	(4)(6)(7)	$W > 29 \leq 100$	1 075 to 1 225	955	8	40	—	940	311 to 375
	(4)(6)(7)	$X > 6 \leq 63$	1 150 to 1 300	1 035	7	34	—	1 020	341 to 401
	(4)(6)(7)	$Z > 6 \leq 63$	1 550 min.	1 250	3	10	—	1 235	444 min.
	Turned, ground or cold drawn and finally softened	—	—	—	—	—	—	—	277 max.
826M40	Hardened and tempered + turned or ground	$U > 150 \leq 250$	925 to 1 075	740	12	34	28	725	269 to 331
		$U > 100 \leq 150$	925 to 1 075	755	12	47	42	740	269 to 331
		$V > 63 \leq 250$	1 000 to 1 150	835	12	34	28	820	293 to 352
	(6)	$V > 63 \leq 150$	1 000 to 1 150	850	12	47	42	835	293 to 352
	(6)	$W > 29 \leq 250$	1 075 to 1 225	925	11	27	22	910	311 to 375
	(6)	$W > 29 \leq 150$	1 075 to 1 225	940	11	40	35	925	311 to 375
	(6)	$X > 29 \leq 150$	1 150 to 1 300	1 020	10	34	28	1 005	341 to 401
	(6)	$Y > 29 \leq 150$	1 225 to 1 375	1 095	10	34	28	1 080	363 to 429
		$Z > 29 \leq 100$	1 550 min.	1 235	7	13	11	1 125	444 min. (4)
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	$U > 100 \leq 150$	925 to 1 075	770	9	47	—	755	269 to 331
		$V > 63 \leq 150$	1 000 to 1 150	865	9	47	—	850	293 to 352
		$W > 29 \leq 150$	1 075 to 1 225	955	8	40	—	940	311 to 375
	(1)(4)(6)(7)	$X > 29 \leq 150$	1 150 to 1 300	1 035	7	34	—	1 020	341 to 401
	(1)(4)(6)(7)	$Y > 29 \leq 150$	1 225 to 1 375	1 110	7	34	—	1 095	363 to 429
	(1)(4)(6)(7)	$Z > 29 \leq 100$	1 550 min. (12)	1 250	5	13	—	1 235	444 min.
	Turned, ground or cold drawn and finally softened								277 max.

[a] See also option **A.3**.

Table 21 — Mechanical properties for alloy steels (18)

Steel	Condition (2)	Size (1) (diameter across flats, or thickness)	R_m	R_e min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB (13)
						Izod min.	KCV min.		
		mm	N/mm^2	N/mm^2	%	J	J	N/mm^2	
945M38	Hardened and tempered + turned or ground	R > 150 ≤ 250	700 to 850	495	15	34	28	480	201 to 255
		R>100 ≤ 150	700 to 850	525	17	54	50	510	201 to 255
		S > 63 ≤ 100	775 to 925	585	15	54	50	570	223 to 277
		T > 29 ≤ 63	850 to 1 000	680	13	54	50	665	248 to 302
		U ≥ 6 ≤ 29	925 to 1 075	755	12	47	42	740	269 to 331
		V ≥ 6 ≤ 29	1 000 to 1 150	850	12	47	42	835	293 to 352
	Hardened and tempered + cold drawn or hardened and tempered + cold drawn + ground	R > 100 ≤ 150	700 to 850	540	13	54	50	525	201 to 255
		S > 63 ≤ 100	775 to 925	600	11	54	50	585	223 to 277
		T > 29 ≤ 63	850 to 1 000	700	10	54	50	680	248 to 302
		U ≥ 6 ≤ 29	925 to 1 075	770	9	47	42	755	269 to 331
		V ≥ 6 ≤ 29	1 000 to 1 150	865	9	47	42	850	293 to 352
	Turned, ground or cold drawn and finally softened								277 max.

[a] See also option **A.3**.

Table 22 — Mechanical properties for case hardening steels

Steel	Test bar diameter	R_m min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		HB (max.) (14) normalized	HB max. (14)		Hardening Temperature
				Izod min.	KCV min.		Subcritically annealed	Normalized and tempered	
	mm	N/mm^2	%	J	J				°C
Carbon steels									
045M10	13	430	18	47	42	—	—	—	—
045A10	19 (5)	430	18	47	42	—	—	—	—
080M15	13	490	16	40	35	—	—	—	—
	19 (5)	460	16	40	35	—	—	—	—
	29	430	18	40	35	—	—	—	—
Carbon manganese steels									
210M15	13	490	16	40	35	—	—	—	—
	19 (5)	460	16	40	35	—	—	—	—
	29	430	18	40	35	—	—	—	—
Alloy steel									
635M15	19	770	12	27	22	207	—	—	820 to 840
637M17	19	930	10	20	16	217	—	—	820 to 840
655M13	19	1 000	9	40	35	—	255	223	800 to 820
655M17	19	770	12	40	35	207	—	—	820 to 840
805M17	19	770	12	27	22	207	—	—	820 to 840
805M20	19	850	11	20	16	207	—	—	820 to 840
815M17	19	1 080	8	27	22	—	255	241	820 to 840
820M17	19	1 160	8	27	22	—	269	248	820 to 840
822M17	19	1 310	8	27	22	—	269	255	820 to 840
835M15	19	1 310	8	34	28	—	277	269	800 to 820[b]

[a] See also option **A.3**.

[b] Also to be stress relieved at not greater than 200 °C.

NOTE Mechanical tests are in the blank carburized condition. Hardness figures are in the condition stated.

Table 23 — Heat treatment and mechanical properties for ferritic and martensitic stainless and heat resisting steels (18)

Steel	Softened condition HB max.	Heat treatment condition	LRS	Heat treatment	R_m	R_e min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB
								Izod min.	KCV min.		
			mm	°C	N/mm^2	N/mm^2	%	J	J	N/mm^2	
Ferritic steels											
403S17	170	—	150	700 to 780 (16)	420 min.	280	20	—	—	245	170 max.
430S17	170	—	63	750 to 820 (17)	430 min.	280	20	—	—	245	170 max.
Martensitic steels											
410S21	207			950 to 1 020 (10)							
		P	150	650 to 750 (11)	550 to 700	370	20	< 63 mm: 54 ≥ 63 mm: 34	—	340	152 to 207
		R	63	600 to 700 (11)	700 to 850	525	15		—	495	201 to 255
416S21	207			950 to 1 020							
		P	150	650 to 750	550 to 700	370	15	34	—	340	152 to 207
		R	63	600 to 700 (11)	700 to 850	525	11	27	—	495	201 to 255
416S29	217			950 to 1 020 (10)							
		R	150	650 to 750 (11)	700 to 850	525	11	27	—	495	201 to 255
		S	29	600 to 700 (11)	775 to 925	585	10	13	—	555	223 to 277
416S37	229			950 to 1 020 (10)							
		R	150	650 to 750 (11)	700 to 850	525	11	27	—	495	201 to 255
		S	150	600 to 700 (11)	775 to 925	585	10	13	—	555	223 to 277
416S41	179			950 to 1 020 (10)							
		P	150	650 to 750 (10)	550 to 700	370	15	34	—	340	152 to 207
		R	63	600 to 700 (11)	700 to 850	525	11	27	—	495	201 to 255
420S29	217			950 to 1 020 (10)							
		R	150	650 to 750 (11)	700 to 850	525	15	< 63 mm: 34 ≥ 63 mm: 27	—	495	201 to 255
		S	29	600 to 700 (11)	775 to 925	585	13		—	555	223 to 277

Table 23 — Heat treatment and mechanical properties for ferritic and martensitic stainless and heat resisting steels (18)

Steel	Softened condition HB max.	Heat treatment condition	LRS	Heat treatment	R_m	R_e min.	A min. on 5.65 $\sqrt{S_o}$	Impact[a]		$R_{p0.2}$ (3) min.	HB
								Izod min.	KCV min.		
			mm	°C	N/mm^2	N/mm^2	%	J	J	N/mm^2	
420S37	229			950 to 1 020 (10)							
		R	150	650 to 750 (11)	700 to 850	525	15	< 63 mm: 34 ≥ 63 mm: 27	—	495	210 to 255
		S	150	600 to 700 (11)	775 to 925	585	13	< 63 mm: 27 ≥ 63 mm: 14	—	555	223 to 277
431S29	277			950 to 1 020							
		T	150	550 to 650	850 to 1 000	680	11	< 63 mm: 34 ≥ 63 mm: 20	—	635	248 to 302

[a] See also option **A.3**.

Table 24 — Softening treatment and mechanical properties for austenitic stainless and heat resisting steels in the finally softened condition[a] (15)

Steel	R_m min.	A min. on 5.65 $\sqrt{S_o}$	$R_{p0.2}$ (3)	$R_{p1.0}$ min.	Sensitization period (see 8.6)
	N/mm^2	%	N/mm^2	N/mm^2	min
302S31	510	40	190	225	—
304S11	480	40	180	215	30
304S15	480	40	195	230	15
304S31	490	40	195	230	15
321S31	510	35	200	235	30
347S31	510	30	205	240	30
316S11	490	40	190	225	30
316S13	490	40	190	225	30
316S31	510	40	205	240	15
316S33	510	40	205	240	15
320S31	510	35	210	245	30
310S31	510	40	205	240	—
303S31	510	40	190	225	—
303S42	510	40	190	225	—
325S31	510	35	200	235	30

[a] These figures are applicable to sections up to 160 mm softened at 1 000 °C to 1 100 °C.

Table 25 — Mechanical properties for austenitic stainless steels in the cold drawn condition (15)

Section	R_m min.	A min. on 5.65 $\sqrt{S_o}$	$R_{p0.2}$ min.	$R_{p1.0}$ min.
mm	N/mm^2	%	N/mm^2	N/mm^2
≤ 19	865	12	695	725
> 19 ≤ 25	790	15	555	585
> 25 ≤ 32	725	20	450	480
> 32 ≤ 38	695	28	340	370
> 38 ≤ 45	650	28	310	340

Table 26 — Mechanical properties for austenitic stainless steels in the softened and finally cold drawn condition (15)

Section	R_m min.	A min. on 5.65 $\sqrt{S_o}$	$R_{p0.2}$ min.	$R_{p1.0}$ min.
mm	N/mm^2	%	N/mm^2	N/mm^2
≤ 19	600	15	375	425
> 19	550	20	325	375

Table 27 — Normalizing for carbon and carbon manganese steels

Steel	Normalizing temperature
	°C
080M15	890 to 920
070M20	880 to 910
080M30	860 to 890
080M40	830 to 860
080M50	810 to 840
070M55	810 to 840
150M19	860 to 900
150M36	840 to 870

Table 28 — Hardening and tempering parameters for free-cutting, carbon and carbon manganese, and alloy steels

Steel	Hardening treatment		Tempering temperature
	Temperature	Quench medium	
	°C		°C
080M30	860 to 890	Oil or water	550 to 660
080M40	830 to 860	Oil	550 to 660
080M50	810 to 840	Oil	550 to 660
070M5	810 to 840	Oil	550 to 660
150M19	860 to 900	Oil or water	550 to 660
150M36	840 to 870	Oil	550 to 660
212M36	840 to 870	Oil	550 to 660
226M44	830 to 860	Oil	550 to 660
530M40	850 to 880	Oil	550 to 700
605M36	840 to 870	Oil	550 to 680
606M36	840 to 870	Oil	550 to 680
709M40	860 to 890	Oil	550 to 700
722M24	880 to 910	Oil	550 to 700
817M40	820 to 850	Oil	660 max.[a]
826M40	820 to 850	Oil	660 max.[a]
945M38	840 to 870	Oil	550 to 680

[a] For these steels the temperature range 280 °C to 500 °C has to be avoided.

Notes to Table 12 to Table 28

1) For cold drawn bar of a diameter or across flat section of less than 6 mm all mechanical properties should be agreed at the time of enquiry and/or order.

2) Normalizing temperatures and hardening and tempering temperatures are given in Table 27 and Table 28.

3) When specifically ordered.

4) Properties cannot always be obtainable by bulk heat treatment of bar but these properties can be achieved by the appropriate heat treatment of components by the purchaser.

5) Preferred size.

6) Often ordered in the softened condition for machining and subsequent heat treatment to achieve these specified mechanical properties.

7) Cold drawn bars are not normally available in this tensile strength range.

8) A maximum silicon content can be agreed between the purchaser and the supplier.

9) Optional addition.

10) Oil or air hardened.

11) Tempered.

12) When 0.2 % proof stress is specified it is recommended that a double tempering treatment be used:

a) 640 °C to 680 °C followed by

b) 590 °C to 610 °C

13) Brinell hardness for guidance only except where material is supplied in the softened condition.

14) Maximum hardness HB (when specified on the order) in the condition of delivery.

15) For magnetic properties see also option **A.2**.

16) Air cooled or furnace cooled.

17) Cooled freely in air.

18) The various tensile strength ranges for the different specifications have been designated with the reference symbol *P* to *Z*, as given in Table 29.

Table 29 — Reference symbols for tensile strength ranges of hardened and tempered material

Reference symbol	Tensile strength[a]
	N/mm^2
P	550 to 700
Q	625 to 775
R	700 to 850
S	775 to 925
T	850 to 1 000
U	925 to 1 075
V	1 000 to 1 150
W	1 075 to 1 225
X	1 150 to 1 300
Y	1 225 to 1 375
Z	1 550 min.

[a] 1 N/mm^2 = 1 MPa
NOTE Other mechanical properties associated with these ranges are as indicated in the relevant tables.

Appendix A Options

NOTE These options may be agreed at the time of enquiry and/or order.

A.1 Hardness tests shall be required for bars supplied in the non-heat treated condition (see **4.2**).

A.2 Certification giving chemical analysis and/or mechanical properties and/or hardenability values shall be supplied (see **4.5**).

A.3 If the standard impact test specified in BS 131-1 is not required KCV values shall be specified (see **8.2**).

A.4 An intercrystalline corrosion test for stainless steels shall be carried out for each cast of steel supplied. If specified a bend test sample shall be prepared and tested in accordance with BS 5903. It shall be sensitized by heating at a temperature of 650 °C for the time specified, followed by cooling in still air. The other provisions of BS 5903 shall apply (see **8.6**).

A.5 Where steels containing lead are required, the lead range shall be stated in the order. If not specifically stated the lead content shall be not less than 0.15 % and not greater than 0.35 % on cast analysis (see **9.1** and **9.3**).

Publication(s) referred to:

BS 131, *Notched bar tests.*

BS 131-1, *The Izod impact test on metals.*

BS 240, *Method for Brinell hardness test and for verification of Brinell hardness testing machines.*

BS 970, *Specification for wrought steels for mechanical and allied engineering purposes.*

BS 970-1, *General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels.*

BS 1134, *Assessment of surface texture.*

BS 1134-1, *Methods and instrumentation.*

BS 4437, *Method for determining hardenability of steel by end quenching (Jominy test).*

BS 4490, *Methods for micrographic determination of the grain size of steel.*

BS 5903, *Method for determination of resistance to intergranular corrosion of austenitic stainless steels: copper sulphate-sulphuric acid method (Moneypenny Strauss test).*

BS 6200, *Sampling and analysis of iron, steel and other ferrous metals.*

BS 6200-3, *Methods of analysis.*

BS 6617, *Determination of decarburization in steel.*

BS 6617-1, *Methods for determining decarburization by microscopic and micro-hardness techniques.*

BS 6617-2, *Methods for determining decarburization by chemical and spectrographic analysis techniques.*

BS Handbook 19, *Methods for the sampling and analysis of iron, steel and other ferrous metals.*

BS EN 10002-1, *Tensile testing of metallic materials — Part 1: Method of test at ambient temperature.*

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QUALITY PLAN

Z QE 41005

Engine Division

COMPONENT : CAMSHAFT (RAW MATERIAL)

PART NO:11Z9910024(11Z4110034) 30Z9910117(30Z4110305) 41Z9900026(41Z4110104) 51Z9910212(51Z4110109)

SCHEMATIC DIAGRAM	SL NO	CHARACTERISTIC	SPECIFICATION	MAJOR INSPECTION FACILITIES REQUIRED	SOURCE INSPECTION				INSPN AT DIVN	REMARKS
					STAGE INSPN	INSPECTION PLAN	QUALITY RECORD YES	QUALITY RECORD NO		
	1	RAW MATERIAL Ø70 & Ø80 Ø60	ES1135-00 ES1129-03(VS53C)	WET ANALYSIS / SPECTROMETER	–	EACH HEAT	_/			QA : QUALITY ASSURANCE POINT INSPECT 100%
		SPHERODISED AND ANNEALING (Ø70 & Ø80)								
	2	a) HARDNESS	AS PER DRG. / SPECIFICATION	BRINELL HARDNESS TESTING MACHINE.	_/	EACH HEAT	_/	–	–	
		b)MACRO EXAMINATION		ACID ETCHING						THIS QUALITY PLAN SHALL BE APPLIED ONLY AFTER THE SAMPLE CLEARANCE
		c) MICRO EXAMINATION								
		i) NON METALLIC INCLUSIONS	AS PER DRG. / SPECIFICATION		_/	EACH HEAT	_/			
		ii) GRAIN SIZE		METALLURGICAL MICROSCOPE						
		iii) DE CARBURISATION (Ø70 & Ø80)		MICRO HARDNESS SURVEY						
		iv) MICROSTRUCTURE (Ø70 & Ø80)		METALLURGICAL MICROSCOPE						
	3	ii) Ø60		METALLURGICAL MICROSCOPE						

* **SAMPLING PLAN (QUALITYPLAN 323 -QP-TDC)**

LOT SIZE	SAMPLE SIZE
2 to 15	3
18 to 100	5
101 to 500	13
501 to 1000	20
1001& above	32

ISSUE NO : 02

SHEET NO : 01 / 02

PREPARED BY : N.Prashanth	N.Prashanth

DATE: 10 / 02 / 2021

APPROVED BY :H.Mukundaraju	

QUALITY PLAN

Z QE 41005

Engine Division

COMPONENT : CAMSHAFT (RAW MATERIAL)

PART NO:11Z9910024(11Z4110034) 30Z9910117(30Z4110305) 41Z9900026(41Z4110104) 51Z9910212(51Z4110109)

SCHEMATIC DIAGRAM	SL NO	CHARACTERISTIC	SPECIFICATION	MAJOR INSPECTION FACILITIES REQUIRED	SOURCE INSPECTION				INSPN AT DIVN	REMARKS
					STAGE INSPN	INSPECTION PLAN	QUALITY RECORD			
							YES	NO		
		QUENCH & TEMPERING (Ø70 & Ø80)								QA : QUALITYASSURANCE POINT INSPECT 100%
	4	a) HARDNESS	ES6304-03	BHN TESTING MACHINE	✓	05NOS IN A BATCH	✓		–	
		b) MICROSTRUCTURE		METALLURGICAL MICROSCOPE		01/EACH HEAT				
		c) DECARBURISATION	ES1135-00		✓	01/EACH HEAT				
		MECHANICAL PROPERTIES (FOR Ø 60 ONLY)								
	5	i) TENSILE STRENGTH	ES1129-03	UNIVERSAL TESTING MACHINE	–	ONE IN EACH LOT	✓	–	–	
		ii) YIELD STRENGTH	ES1129-03							
		iii)% ELONGATION	ES1129-03							
		CUT TO LENGTH								
	6	Ø 80 (170 SERIES)	1400 +3 /-00	MEASURING TAPE	✓	QA	✓		–	
		Ø 70(140 SERIES)	1115 +3 / -00							
		Ø 70(125 SERIES)	1015 +3 / -00							
		Ø 60(105 SERIES)	860 +3 / -00							
	7	**BEND**								
		Ø 80, Ø 70 & Ø 60	2mm/Mtr	SURFACE TABLE / STRAIGHT EDGE						

SHEET NO : 02 / 02

PREPARED BY : N.Prashanth	N.Prashanth

ISSUE NO : 02
DATE: 10/02/2021

APPROVED BY :H.Mukundaraju	

QUALITY PLAN FOR 225RSB9768

वी ई एम एल
beml

Part No: 225RSB9768 *DOC NO : HP-QH-REC-QP-RM-013 /Rev 00 Dtd 17.07.2024*

Sl No	Description / Component	Characteristics / Parameters / Type of check	Quantum of Check	Testing Standards	Accepted standards / Specs	Format of Record	Inspection	
							M	BEML
1	Material	Composition	1/Heat	Standard	X20Cr13 Grade of IS1570 (or) AISI420 (En 56B)	NABL Report	P	V / P
2	Delivery Condition	Heat Treatment	100%	Standard	Annealed Quenched (or) Solution Treated	HT Record	P	V
3	Mechanical Properties*	Hardness	1/ Heat	Standard	Brinell Hardness 241 Max	Test Report	P	V
4	Surface condition	Visual Inspection	100%	Standard	Free from flute cracks, Gassy, Butt tears, splash, flakes and any other visual defects.	Visual Report	P	A
5	Dimensions	Measure	100%	Standard	Shall confirm to standard / tender conditions Permissible deviation in straightness shall not exceed 3mm / 1000mm length.	Check sheet	P	P
6	Identification Marks	Visual Inspection	100%	-	Part number, Heat Number, Material, Vendor code shall be provided on item.	-	P	V

LEGEND - M -Manufacturer, P - Perform, V- Verification of documents, A- Audit checking, *- If applicable

TABLE 1 (Ref: IS 2500-Part 1:2000)		
LOT SIZE	General Inspection level I	SAMPLE SIZE
2 ~ 90	C	5
91~150	D	8
151~280	E	13
281~500	F	20
501~1200	G	32
1201~3200	H	50
3201~10000	J	80

Note:

1) This Quality plan will applicable only for 225RSB9768 part no.

2) Warranty /Guarantee certificate shall be provided as per terms & conditions of Purchase order

Prepared by
Harika Reddy A
17/07/2024

Reviewed by
Dinesh G
17/7/2024

Approved by
Ganapati Bhat
GANAPATI BHAT KOTI
Deputy General Manager
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EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 1 of 5
	MODEL		DOC No.	QAP/C1001RM
	PART NAME	C1001 ROUND	ISSUE No.	01
	PART NUMBER	C100108/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS& OPEN FREE FORGED BARS	Manufacturing route	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. Hot rolling is preferable In case of higher diameter above 120 mm free open forged bars stock are also permitted with due regard for machining allowances.Free/Open forged bars have higher dimensional tolerances than is applicable for Hot rolled bars.	MILL TC	P	R
2		Supply condition	METALLOGRAPHY / HT CYCLE	--	Round bars above 12 mm shall be supplied in Normalized condition	HT cycle report/ hardness report	P	R
3		Chemical Composition	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1001 as below as mentioned in & reports to be submitted along with supply Elements / Requirement C / 0.24 Max Si / 0.43 Max Mn / 1.55 Max S / 0.05 Max P / 0.05 Max Total Micro alloy elements(Ti, V,Nb,B etc)shall not exceed 0.25% Nitrogen content shall not exceed 0.012% Copper may be present up to 0.20% Max Supplier shall ensure that elements not indicated above shall not present in product	MILL TC/ NABL LAB REPORT	P	R
4		Carbon equivalent	Carbon equivalent calculation from chemistry		0.41 Max	Mill TC/NABL lab report	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 5
	MODEL		DOC No.	QAP/C1001RM
	PART NAME	C1001 ROUND	ISSUE No.	01
	PART NUMBER	C100108/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
5	HOT ROLLED BARS& OPEN FREE FORGED BARS	Reduction ratio	MILL TC		Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
6		Mechanical properties	Mechanical properties testing on specimen	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for Mechanical properties as per C1001 standard	Mill TC/NABL lab report	P	R

Parameters	requirements
Ultimate Tensile strength, MPa	410 Min
Yield strength ,Mpa	250 Min for diameter less than 20 mm
	240 min for diameter between 20 &40 mm
	230 Min for diameter Above 40 mm
% Elongation	23 Min

EM DIVISION	**QUALITY ASSURANCE PLAN**		**Sheet No: 3 of 5**
	MODEL		DOC No.	**QAP/C1001RM**
	PART NAME	**C1001 ROUND**	ISSUE No.	**01**
	PART NUMBER	**C100108/09**	DATE	**05/08/2024**

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
7	HOT ROLLED BARS& OPEN FREE FORGED BARS	Mechanical properties	Mechanical properties testing on specimen	One sample/ heat /cast batch	**Pa**rameters: Impact strength charpy V notch @0 deg c — requirements: 27 Joules min	Mill TC/NABL lab report	**P**	**R**
8		Macro examination	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	MILL TC/ NABL LAB REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 5
	MODEL		DOC No.	QAP/C1001RM
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	PART NUMBER	C100108/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
9	HOT ROLLED BARS& OPEN FREE FORGED BARS	DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as follows Over / Up to and including / Tolerance mm -- / 25 / ± 0.5 25 / 35 / ± 0.6 35 / 50 / ± 0.8 50 / 80 / ± 1.0 80 / 100 / ± 1.3 100 / -- / ± 1.6% of diameter The permissible ovality (out of round)measured as the difference between the maximum & minimum diameters shall be 75% of the total tolerances(plus and minus) specified on the diameter In case of Hot forged bars Tolerances on OD shall be ± 5 mm of Nominal OD	DIMENSION CHECK SHEET	P	R
10								
11		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 5 mm per 1000 mm length in case of Hot rolled bars & 3 mm per 1000 mm length in case of Hot forged bars	DIMENSION CHECK SHEET	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 5 of 5
	MODEL		DOC No.	QAP/C1001RM
	PART NAME	C1001 ROUND	ISSUE No.	01
	PART NUMBER	C100108/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
12	HOT ROLLED BARS& OPEN FREE FORGED BARS	Visual Examination	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, Mill scale & rust	TEST REPORT	P	R
13		MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL	
2 ~ 50	8	1.5%	**P - Perform the Activity** **W - Witnessing of Activity** **R - Reviewing of QA Report** **A – Audit check the activity**
51 ~ 90	13	1.0%	
91~150	20	0.65%	
151~280	32	0.40%	
281~500	50	0.25%	
501~1200	80	0.15%	
1201~3200	125	0.10%	
3201~10000	200	0.065%	

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR **Sr. Manager – Receiving Quality**	**MAHESH KULKARNI** **DGM – Receiving Quality**		**Chief of Quality Engineering**

EM DIVISION	**QUALITY ASSURANCE PLAN**		**Sheet No: 1 of 4**
	MODEL		DOC No.	**QAP/C1001RM**
	PART NAME	**C1001 SQUARE BARS**	ISSUE No.	**01**
	PART NUMBER	**C1001 11**	DATE	**05/08/2024**

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED SQUARE BARS	Manufacturing route	MILL TC	--	Hot rolling process reduction from higher diameter to the required size& shall be supplied in straight lengths	MILL TC	P	R
2		Supply condition	METALLOGRAPHY / HT CYCLE	--	Square bars shall be supplied in Normalized condition	HT cycle report/ hardness report	P	R
3		Chemical Composition	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1001 as below as mentioned in & reports to be submitted along with supply Elements / Requirement C 0.24 Max Si 0.43 Max Mn 1.55 Max S 0.05 Max P 0.05 Max Total Micro alloy elements(Ti, V,Nb,B etc)shall not exceed 0.25% Nitrogen content shall not exceed 0.012% Copper may be present up to 0.20% Max Supplier shall ensure that elements not indicated above shall not present in product	MILL TC/ NABL LAB REPORT	P	R
4		Carbon equivalent	Carbon equivalent calculation from chemistry		0.41 Max	Mill TC/NABL lab report	P	R
5		Reduction ratio	MILL TC		Square Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & square Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 4
	MODEL		DOC No.	QAP/C1001RM
	PART NAME	C1001 SQUARE BARS	ISSUE No.	01
	PART NUMBER	C1001 11	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
6	HOT ROLLED SQUARE BARS	Mechanical properties	Mechanical properties testing on specimen	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for Mechanical properties as per C1001 standard Parameters: requirements Ultimate Tensile strength, MPa: 410 Min Yield strength ,Mpa: 250 Min for width less than 20 mm; 240 min for width between 20 &40 mm; 230 Min for diameter width 40 mm % Elongation: 23 Min	Mill TC/NABL lab report	P	R
7		Mechanical properties	Mechanical properties testing on specimen	One sample/ heat /cast batch	Parameters: requirements Impact strength charpy V notch @0 deg c: 27 Joules min	Mill TC/NABL lab report	P	R

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
8	HOT ROLLED SQUARE BARS	Macro examination	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	MILL TC/ NABL LAB REPORT	P	R
9		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Tolerances for square bars supplied in straight lengths as per IS1852 latest issuance Over / Up to and including / Tolerance mm -- / 25 / ± 0.5 25 / 35 / ± 0.6 35 / 50 / ± 0.8 50 / 80 / ± 1.0 80 / 100 / ± 1.3 100 / -- / ± 1.6% of side width Side width The permissible out of squareness of square bars measures as the distance between parallel faces across any cross sections shall be 75% of the total tolerance(Plus & minus) specified on side widths	DIMENSION CHECK SHEET	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 4
	MODEL		DOC No.	QAP/C1001RM
	PART NAME	C1001 SQUARE BARS	ISSUE No.	01
	PART NUMBER	C1001 11	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
11	HOT ROLLED SQUARE BARS	STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm per 1000 mm length	DIMENSION CHECK SHEET	P	R
12		VISUAL EXAMINATION	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, Mill scale & rust	TEST REPORT	P	R
13		MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL
2 ~ 50	8	1.5%
51 ~ 90	13	1.0%
91~150	20	0.65%
151~280	32	0.40%
281~500	50	0.25%
501~1200	80	0.15%
1201~3200	125	0.10%
3201~10000	200	0.065%

P - Perform the Activity
W - Witnessing of Activity
R - Reviewing of QA Report
A – Audit check the activity

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

BEML LTD	QUALITY PLAN	DOC NO	323-QP-QEL -RM -TYP SIZE
EM DIVISION	QUALITY PLAN FOR C1002 88 TYPICAL SIZES	ISSUE NO	1
		PAGE NO	1 OF 2

Purpose

1 To establish procedures for inspection and testing of C1002 88 SQUARE BARS WITH TYPICAL SIZES Rawmaterials

Scope

2 Covers inspection and testing of C1002 88 Typical sizes

Responsibility

3 1) The section head of materials group to ensure that the quality plan is sent to all suppliers along with the purchase order
2) The supplier has to ensure implementation of the quality plan.

Procedure

4 The quality plan is applicable for for the C1002 88 with Typical sizes

	Name	Signature	Date
Prepared by	C.VASANTHAKUMAR	sd	24.03.2023
Approved by	MAHESH KULKARNI	sd	24.03.2023

BEML LTD	QUALITY PLAN	DOC NO	323-QP-QEL -RM -TYP SIZE
EM DIVISION	QUALITY PLAN FOR C1002 88 TYPICAL SIZES	ISSUE NO	1
		PAGE NO	1 OF 2

BEML LTD	QUALITY PLAN	DOC NO	323-QP-QEL -RM -TYP SIZE
EM DIVISION	QUALITY PLAN FOR C1002 88 TYPICAL SIZES	ISSUE NO	1
		PAGE NO	1 OF 2

BEML LTD	QUALITY PLAN	DOC NO	323-QP-QEL -RM -TYP SIZE
EM DIVISION	QUALITY PLAN FOR C1002 88 WITH TYPICAL SIZES	ISSUE NO	1
		PAGE NO	2 OF 2

Table -1

SLNO	TEST DESCRIPTION	PERIODICITY OF TESTS		
1	Visual examination	Material supplied shall be free from mill scale, heavy rust , corrosion pitting cracks and laminations		
2	SUPPLY CONDITION	A) Weld repair for removal of surface defects is not permissible. B) The plates shall be provided with a corrosion preventive coating to suit transit and storage. C) Plates above 12mm thickness shall be supplied in normalised condition.		
3	DIMENSIONS	Dimensional check shall be carried out on on typical plate as per sampling plan as mentioned below. *		
4	SPECIFIC REQUIREMENTS . Free from defects-weld repair :	FREE FROM DEFECTS WELD REPAIR		
5	CHEMICAL COMPOSITION	Chemical composistion to be tested for every batch & reports to be attached . Chemistry shall meets any one of following grades of C1002 company standard		
		Elements	**Grade A**	**Grade B**
		Carbon (C) (Max.)	0.20	0.20
		Silicon (Si) (Max.)	0.45	0.45
		Manganese (Mn) (Max.)	1.55	1.60
		Phosphorus (P) (Max.)	0.040	0.040
		Sulphur (S) (Max.)	0.040	0.040
6	CARBON EQUIVALENT (C.E)	Carbon equiavalent shall be calculated & reported . It shall meets any one of following grades of C1002 company standard		
		C.E=C+(Mn/6) + [(Cr+Mo+V)/5] + [(Ni+Cu)/15]	0.45	0.50
7	MECHANICAL PROPERTIES	Mechanical properties to be tested for every batch & reports to be attached . Mechanical propeties shall meets any one of following grades of C1002 company standard		
		Tensile Strength min. (Mpa)	490	540
		Yield Strength min. (Mpa)		
		Upto 20 mm	350	410
		20mm - 40mm	330	390
		Above 40mm	320	380
		Elongation in % (Min.)	22	22
		Impact test piece	Size 10mmX10mm	Size 10mmX10mm
		Impact V-notch (J) Min. Guaranteed at -20 deg. C (Min.)	27	25
8	BEND TEST	**Bend test to be tested for every batch & reports to be attachedas per following method & results shall be reported**		
		INTERNAL BEND DIAMETER, (Min.) for plate thickness $\leq$ 25 mm	2T	2T
		INTERNAL BEND DIAMETER, (Min.) for plate thickness $\geq$25 mm	Nil	Nil

BEML LTD	QUALITY PLAN	DOC NO	323-QP-QEL -RM -TYP SIZE
EM DIVISION	QUALITY PLAN FOR C1002 88 TYPICAL SIZES	ISSUE NO	1
		PAGE NO	1 OF 2

9	ULTRASONIC TEST (UT)	Plate supplies of thickness 10mm and over, shall confirm to ultasonic test requirements as per ASTM A578, Level B

NOTE : SAMPLING PLAN *

Sampling Plan : As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos	Sample Size in Nos
2 ~ 50	8
51 ~ 90	13
91~150	20
151~280	32
281~500	50
501~1200	80
1201~3200	125
3201~10000	200

	Name	Signature	Date
Prepared by	C.VASANTHAKUMAR	sd	24.03.2023
Approved by	MAHESH KULKARNI	sd	24.03.2023

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 1 of 3
	MODEL		DOC No.	QAP/C1101RM
	PART NAME	C1101 ROUND	ISSUE No.	01
	PART NUMBER	C110108/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS& OPEN FREE FORGED BARS	Manufacturing route	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. Hot rolling is preferable In case of higher diameter above 120 mm free open forged bars stock are also permitted with due regard for machining allowances.Free/Open forged bars have higher dimensional tolerances than is applicable for Hot rolled bars. The steel shall be of Fully Killed Type.	MILL TC	P	R
2		Supply condition	METALLOGRAPHY / HT CYCLE	--	Round bars above 12 mm shall be supplied in Normalized condition with hardness range of 180/210 BHN.condition	HT cycle report/ hardness report	P	R
3		Chemical Composition	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1101 as below as mentioned in & reports to be submitted along with supply Elements / Requirement C 0.42/0.50 Si 0.10/0.40 Mn 0.60/0.90 S 0.04 Max P 0.04Max Cr 0.20 Max Ni 0.25 Max Mo 0.05 Max Cu 0.35Max V 0.05Max Ti 0.05 Max Besides the percentage weight of all trace elements put together shall not exceed 0.8%	MILL TC/ NABL LAB REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 3
	MODEL		DOC No.	QAP/C1101RM
	PART NAME	C1101 ROUND	ISSUE No.	01
	PART NUMBER	C110108/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED BARS& OPEN FREE FORGED BARS	Reduction ratio	MILL TC		Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
5		Grain size	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be in the range of ASTM Grain size 5 to 8(Or Equivalent size no as per IS2853 latest issuance)	MILL TC/ NABL LAB REPORT	P	R
6		Inclusion rating	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 3.0(thin & thick) of IS 4163 latest issuance & material shall be free from slag inclusions. The same shall be reported along with every batch of supplies.	MILL TC/ NABL LAB REPORT	P	R
7		Macro examination	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	MILL TC/ NABL LAB REPORT	P	R
8		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances	DIMENSION CHECK SHEET	P	R
9								
10		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm in any 1000 mm length	DIMENSION CHECK SHEET	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 3 of 3
	MODEL		DOC No.	QAP/C1101RM
	PART NAME	C1101 ROUND	ISSUE No.	01
	PART NUMBER	C110108/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
11	HOT ROLLED BARS& OPEN FREE FORGED BARS	Visual Examination	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust	TEST REPORT	P	R
12		MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL
2 ~ 50	8	1.5%
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281~500	50	0.25%
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1201~3200	125	0.10%
3201~10000	200	0.065%

P - Perform the Activity
W - Witnessing of Activity
R - Reviewing of QA Report
A – Audit check the activity

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

EM DIVISION	**QUALITY ASSURANCE PLAN**		**Sheet No: 1 of 3**
	MODEL		DOC No.	**QAP/C1101RM**
	PART NAME	**C1101 SQUARE BARS**	ISSUE No.	**01**
	PART NUMBER	**C1101 11**	DATE	**05/08/2024**

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED SQUARE BARS	Manufacturing route	MILL TC	--	Hot rolling process reduction from higher diameter to the required size& shall be supplied in straight lengths . The steel shall be of Fully Killed Type.	MILL TC	P	R
2		Supply condition	METALLOGRAPHY / HT CYCLE	--	Square bars shall be supplied in Normalized condition with hardness range of 180/210 BHN.condition	HT cycle report/ hardness report	P	R
3		Chemical Composition	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1101 as below as mentioned in & reports to be submitted along with supply Elements / Requirement C 0.42/0.50 Si 0.10/0.40 Mn 0.60/0.90 S 0.04 Max P 0.04Max Cr 0.20 Max Ni 0.25 Max Mo 0.05 Max Cu 0.35Max V 0.05Max Ti 0.05 Max Besides the percentage weight of all trace elements put together shall not exceed 0.8%	MILL TC/ NABL LAB REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN		Sheet No: 2 of 3
	MODEL		DOC No.	QAP/C1101RM
	PART NAME	C1101 SQUARE BARS	ISSUE No.	01
	PART NUMBER	C1101 11	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED SQUARE BARS	Reduction ratio	MILL TC		Square Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum &square Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
5		Grain size	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be in the range of ASTM Grain size 5 to 8(Or Equivalent size no as per IS2853 latest issuance)	MILL TC/ NABL LAB REPORT	P	R
6		Inclusion rating	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 3.0(thin & thick) of IS 4163 latest issuance & material shall be free from slag inclusions. The same shall be reported along with every batch of supplies.	MILL TC/ NABL LAB REPORT	P	R
7		Macro examination	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	MILL TC/ NABL LAB REPORT	P	R
8		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances	DIMENSION CHECK SHEET	P	R
9								
10		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm in any 1000 mm length	DIMENSION CHECK SHEET	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 3 of 3
	MODEL		DOC No.	QAP/C1101RM
	PART NAME	C1101 SQUARE BARS	ISSUE No.	01
	PART NUMBER	C1101 11	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
11	HOT ROLLED SQUARE BARS	Visual Examination	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust	TEST REPORT	P	R
12		MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL
2 ~ 50	8	1.5%
51 ~ 90	13	1.0%
91~150	20	0.65%
151~280	32	0.40%
281~500	50	0.25%
501~1200	80	0.15%
1201~3200	125	0.10%
3201~10000	200	0.065%

P - Perform the Activity
W - Witnessing of Activity
R - Reviewing of QA Report
A – Audit check the activity

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality	GES	Chief of Quality Engineering

EM DIVISION	QUALITY ASSURANCE PLAN		Sheet No: 1 of 4
	MODEL		DOC No.	QAP/C1204 RM
	PART NAME	C1204 ROUND	ISSUE No.	01
	PART NUMBER	C120408/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS& OPEN FREE FORGED BARS	MANUFACTURING ROUTE	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. Hot rolling is preferable In case of higher diameter above 125 mm free open forged bars stock are also permitted with due regard for machining allowances.Free/Open forged bars have higher dimensional tolerances than is applicable for Hot rolled bars. The steel shall be of Fully Killed Type.	MILL TC	P	R
2		SUPPLY CONDITION	METALLOGRAPHY / HT CYCLE	--	Round bars shall be supplied in Normalized condition with hardness range of 180/229 BHN.condition	HT cycle report/ hardness report	P	R
3		CHEMICAL COMPOSITION	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1204 as below as mentioned in & reports to be submitted along with supply Elements: Requirement C: 0.19/0.25 Si: 0.15/0.30 Mn: 0.60/0.95 S: 0.04 Max P: 0.035 Max Cr: 0.35/0.65 Ni: 0.35/0.75 Mo: 0.15/0.25 Cu: 0.25 Max V: 0.05 Max	MILL TC/ LAB REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 4
	MODEL		DOC No.	QAP/C1204 RM
	PART NAME	C1204 ROUND	ISSUE No.	01
	PART NUMBER	C120408/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED BARS& OPEN FREE FORGED BARS	REDUCTION RATIO	MILL TC		Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
5		GRAIN SIZE	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be in the range of ASTM Grain size 5 to 8(Or Equivalent size no as per IS4748 latest issuance)	NABL LAB REPORT/ MILL TC	P	R
6		INCLUSION RATING	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 3.0(thin & thick) of IS 4163 latest issuance & material shall be free from slag inclusions. The same shall be reported along with every batch of supplies.	NABL LAB REPORT/ MILL TC	P	R
7		MACRO EXAMINATION	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	NABL LAB REPORT/ MILL TC	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 3 of 4
	MODEL		DOC No.	QAP/C1204 RM
	PART NAME	C1204 ROUND	ISSUE No.	01
	PART NUMBER	C120408/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
8	HOT ROLLED BARS& OPEN FREE FORGED BARS	JOMINY HARDENABILITY	JOMINY (TEST AS PER IS3448 -1981)	ONE SPECIMEN PER HEAT	The Jominy end quench values shall be ensured (TEST AS PER IS3848 -1981) as follows Distance from quench end in mm / Hardness limits: Min / Max 1.5: 41 / 48 6.0: 28 / 42 9.0: 22 / 35 13.5: - / 30 18.0: - / 27	NABL LAB REPORT/ MILL TC	P	R
9		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances	DIMENSION CHECK SHEET	P	R
10		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm in any 1000 mm length	DIMENSION CHECK SHEET	P	R
11		VISUAL EXAMINATION	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust	TEST REPORT	P	R
12		MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 4
	MODEL		DOC No.	QAP/C1204 RM
	PART NAME	C1204 ROUND	ISSUE No.	01
	PART NUMBER	C120408/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL	
2 ~ 50	8	1.5%	**P - Perform the Activity** **W - Witnessing of Activity** **R - Reviewing of QA Report** **A – Audit check the activity**
51 ~ 90	13	1.0%	
91~150	20	0.65%	
151~280	32	0.40%	
281~500	50	0.25%	
501~1200	80	0.15%	
1201~3200	125	0.10%	
3201~10000	200	0.065%	

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

EM DIVISION	QUALITY ASSURANCE PLAN		Sheet No: 1 of 4
	MODEL		DOC No.	QAP/C1205 RM
	PART NAME	C1205 ROUND	ISSUE No.	01
	PART NUMBER	C120508/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS& OPEN FREE FORGED BARS	MANUFACTURING ROUTE	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. Hot rolling is preferable In case of higher diameter above 125 mm free open forged bars stock are also permitted with due regard for machining allowances.Free/Open forged bars have higher dimensional tolerances than is applicable for Hot rolled bars. The steel shall be of Fully Killed Type.	MILL TC	P	R
2		SUPPLY CONDITION	METALLOGRAPHY / HT CYCLE	--	Round bars shall be supplied in Normalized condition with hardness range of 180/229 BHN.condition	HT cycle report/ hardness report	P	R
3		CHEMICAL COMPOSITION	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1205 as below as mentioned in & reports to be submitted along with supply	MILL TC/ LAB REPORT	P	R

Elements	Requirement
C	0.17/0.23
Si	0.15/0.30
Mn	0.40/0.70
S	0.04 Max
P	0.035 Max
Cr	0.35/0.65
Ni	1.55/2.00
Mo	0.20/0.30
Cu	0.25 Max
V	0.05 Max

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 4
	MODEL		DOC No.	QAP/C1205 RM
	PART NAME	C1205 ROUND	ISSUE No.	01
	PART NUMBER	C120508/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED BARS& OPEN FREE FORGED BARS	REDUCTION RATIO	MILL TC		Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
5		GRAIN SIZE	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be in the range of ASTM Grain size 5 to 8(Or Equivalent size no as per IS4748 latest issuance)	NABL LAB REPORT/ MILL TC	P	R
6		INCLUSION RATING	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 3.0(thin & thick) of IS 4163 latest issuance & material shall be free from slag inclusions. The same shall be reported along with every batch of supplies.	NABL LAB REPORT/ MILL TC	P	R
7		MACRO EXAMINATION	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	NABL LAB REPORT/ MILL TC	P	R

EM DIVISION	**QUALITY ASSURANCE PLAN**		**Sheet No: 3 of 4**
	MODEL		DOC No.	**QAP/C1205 RM**
	PART NAME	**C1205 ROUND**	ISSUE No.	**01**
	PART NUMBER	**C120508/09**	DATE	**05/08/2024**

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
8	HOT ROLLED BARS& OPEN FREE FORGED BARS	JOMINY HARDENABILITY	JOMINY (TEST AS PER IS3448 -1981)	ONE SPECIMEN PER HEAT	The Jominy end quench values shall be ensured (TEST AS PER IS3848 -1981) as follows Distance from quench end in mm / Hardness limits: Min / Max 1.5: 41 / 48 6.0: 32 / 44 9.0: 27 / 39 13.5: 23 / 33 18.0: 20 / 30	NABL LAB REPORT/ MILL TC	P	R
9		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances	DIMENSION CHECK SHEET	P	R
10		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm in any 1000 mm length	DIMENSION CHECK SHEET	P	R
11		VISUAL EXAMINATION	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust	TEST REPORT	P	R
12		MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 4
	MODEL		DOC No.	QAP/C1205 RM
	PART NAME	C1205 ROUND	ISSUE No.	01
	PART NUMBER	C120508/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL	
2 ~ 50	8	1.5%	**P - Perform the Activity** **W - Witnessing of Activity** **R - Reviewing of QA Report** **A – Audit check the activity**
51 ~ 90	13	1.0%	
91~150	20	0.65%	
151~280	32	0.40%	
281~500	50	0.25%	
501~1200	80	0.15%	
1201~3200	125	0.10%	
3201~10000	200	0.065%	

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 1 of 4
	MODEL		DOC No.	QAP/C1209 RM
	PART NAME	C1209 ROUND	ISSUE No.	01
	PART NUMBER	C120908/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS& OPEN FREE FORGED BARS	MANUFACTURING ROUTE	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. Hot rolling is preferable In case of higher diameter above 125 mm free open forged bars stock are also permitted with due regard for machining allowances.Free/Open forged bars have higher dimensional tolerances than is applicable for Hot rolled bars. The steel shall be of Fully Killed Type.	MILL TC	P	R
2		SUPPLY CONDITION	METALLOGRAPHY / HT CYCLE	--	Round bars shall be supplied in Normalized condition with hardness range of 180/229 BHN.condition	HT cycle report/ hardness report	P	R
3		CHEMICAL COMPOSITION	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1209 as below as mentioned in & reports to be submitted along with supply Elements / Requirement C / 0.32/0.38 Si / 0.15/0.30 Mn / 0.60/1.00 S / 0.04 Max P / 0.035 Max Cr / 0.75/1.20 Mo / 0.15/0.25 Besides the percentage weight of all trace elements put together shall not exceed 0.25%	MILL TC/ LAB REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 4
	MODEL		DOC No.	QAP/C1209 RM
	PART NAME	C1209 ROUND	ISSUE No.	01
	PART NUMBER	C120908/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED BARS& OPEN FREE FORGED BARS	REDUCTION RATIO	MILL TC		Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
5		GRAIN SIZE	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be in the range of ASTM Grain size 5 to 8(Or Equivalent size no as per IS4748 latest issuance)	NABL LAB REPORT/ MILL TC	P	R
6		INCLUSION RATING	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 3.0(thin & thick) of IS 4163 latest issuance & material shall be free from slag inclusions. The same shall be reported along with every batch of supplies.	NABL LAB REPORT/ MILL TC	P	R
7		MACRO EXAMINATION	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	NABL LAB REPORT/ MILL TC	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 3 of 4
	MODEL		DOC No.	QAP/C1209 RM
	PART NAME	C1209 ROUND	ISSUE No.	01
	PART NUMBER	C120908/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
8	HOT ROLLED BARS& OPEN FREE FORGED BARS	JOMINY HARDENABILITY	JOMINY (TEST AS PER IS3448 -1981)	ONE SPECIMEN PER HEAT	The Jominy end quench values shall be ensured (TEST AS PER IS3848 -1981) as follows Distance from quench end in mm / Hardness limits: Min / Max 1.5: 51 / 58 9.0: 45 / 55 19: 33 / 49	NABL LAB REPORT/ MILL TC	P	R
9		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances	DIMENSION CHECK SHEET	P	R
10		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm in any 1000 mm length	DIMENSION CHECK SHEET	P	R
11		VISUAL EXAMINATION	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust	TEST REPORT	P	R
12		MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 4
	MODEL		DOC No.	QAP/C1209 RM
	PART NAME	C1209 ROUND	ISSUE No.	01
	PART NUMBER	C120908/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL	
2 ~ 50	8	1.5%	**P - Perform the Activity** **W - Witnessing of Activity** **R - Reviewing of QA Report** **A – Audit check the activity**
51 ~ 90	13	1.0%	
91~150	20	0.65%	
151~280	32	0.40%	
281~500	50	0.25%	
501~1200	80	0.15%	
1201~3200	125	0.10%	
3201~10000	200	0.065%	

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

EM DIVISION	**QUALITY ASSURANCE PLAN**		**Sheet No: 1 of 4**
	MODEL		DOC No.	**QAP/C1210 RM**
	PART NAME	**C1210 ROUND**	ISSUE No.	**01**
	PART NUMBER	**C1210 08/09**	DATE	**05/08/2024**

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS& OPEN FREE FORGED BARS	MANUFACTURING ROUTE	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. Hot rolling is preferable In case of higher diameter above 125 mm free open forged bars stock are also permitted with due regard for machining allowances.Free/Open forged bars have higher dimensional tolerances than is applicable for Hot rolled bars. The steel shall be of Fully Killed Type.	MILL TC	P	R
2		SUPPLY CONDITION	METALLOGRAPHY / HT CYCLE	--	Round bars shall be supplied in Normalized condition with hardness range of 240/277 BHN.condition	HT cycle report/ hardness report	P	R
3		CHEMICAL COMPOSITION	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYS IS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1210 as below as mentioned in & reports to be submitted along with supply Elements: Requirement C: 0.37/0.44 Si: 0.15/0.35 Mn: 0.55/0.90 S: 0.04 Max P: 0.035 Max Ni: 1.55/2.00 Cr: 0.65/0.95 Mo: 0.20/0.30	MILL TC/ LAB REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 4
	MODEL		DOC No.	QAP/C1210 RM
	PART NAME	C1210 ROUND	ISSUE No.	01
	PART NUMBER	C1210 08/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED BARS& OPEN FREE FORGED BARS	REDUCTION RATIO	MILL TC		Hot rolled shall have reduction ratio of 6:1 minimum & Hot forged round bars shall have reduction ratio of 4:1 minimum	MILL TC	P	R
5		GRAIN SIZE	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be in the range of ASTM Grain size 5 to 8(Or Equivalent size no as per IS4748 latest issuance)	NABL LAB REPORT/ MILL TC	P	R
6		INCLUSION RATING	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 3.0(thin & thick) of IS 4163 latest issuance & material shall be free from slag inclusions. The same shall be reported along with every batch of supplies.	NABL LAB REPORT/ MILL TC	P	R
7		MACRO EXAMINATION	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random conditions & centre segregations exceeding severity levels of S-3 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from the centre	NABL LAB REPORT/ MILL TC	P	R

EM DIVISION	QUALITY ASSURANCE PLAN		Sheet No: 3 of 4
	MODEL		DOC No.	QAP/C1210 RM
	PART NAME	C1210 ROUND	ISSUE No.	01
	PART NUMBER	C1210 08/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
8	HOT ROLLED BARS& OPEN FREE FORGED BARS	JOMINY HARDENABILITY	JOMINY (TEST AS PER IS3448 -1981)	ONE SPECIMEN PER HEAT	The Jominy end quench values shall be ensured (TEST AS PER IS3848 -1981) as follows Distance from quench end in mm / Hardness limits: Min / Max 1.5: 53 / 60 13.5: 52 / 60 19.5: 50 / 59 24: 48 / 58 50: 40 / 56	NABL LAB REPORT/ MILL TC	P	R
9		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances	DIMENSION CHECK SHEET	P	R
10		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm in any 1000 mm length	DIMENSION CHECK SHEET	P	R
11		VISUAL EXAMINATION	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust	TEST REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 4
	MODEL		DOC No.	QAP/C1210 RM
	PART NAME	C1210 ROUND	ISSUE No.	01
	PART NUMBER	C1210 08/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
12	HOT ROLLED BARS& OPEN FREE FORGED BARS	MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL
2 ~ 50	8	1.5%
51 ~ 90	13	1.0%
91~150	20	0.65%
151~280	32	0.40%
281~500	50	0.25%
501~1200	80	0.15%
1201~3200	125	0.10%
3201~10000	200	0.065%

P - Perform the Activity
W - Witnessing of Activity
R - Reviewing of QA Report
A – Audit check the activity

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 1 of 4
	MODEL		DOC No.	QAP/C1212 RM
	PART NAME	C1212 ROUND	ISSUE No.	01
	PART NUMBER	C121208/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS& OPEN FREE FORGED BARS	MANUFACTURING ROUTE	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. Hot rolling is preferable In case of higher diameter above 125 mm free open forged bars stock are also permitted with due regard for machining allowances.Free/Open forged bars have higher dimensional tolerances than is applicable for Hot rolled bars. The steel shall be of Fully Killed Type.	MILL TC	P	R
2		SUPPLY CONDITION	METALLOGRAPHY / HT CYCLE	--	Round bars shall be supplied in Normalized condition with hardness range of 180/229 BHN.condition	HT cycle report/ hardness report	P	R
3		CHEMICAL COMPOSITION	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYS IS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1212 as below as mentioned in & reports to be submitted along with supply Elements: Requirement C: 0.37/0.44 Si: 0.15/0.35 Mn: 0.65/1.10 S: 0.04 Max P: 0.035 Max Cr: 0.75/1.20 Mo: 0.15/0.25 Besides the percentage weight of all trace elements put together shall not exceed 0.25%	MILL TC/ LAB REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 4
	MODEL		DOC No.	QAP/C1212 RM
	PART NAME	C1212 ROUND	ISSUE No.	01
	PART NUMBER	C121208/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED BARS& OPEN FREE FORGED BARS	REDUCTION RATIO	MILL TC		Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
5		GRAIN SIZE	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be in the range of ASTM Grain size 5 to 8(Or Equivalent size no as per IS4748 latest issuance)	NABL LAB REPORT/ MILL TC	P	R
6		INCLUSION RATING	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 2.0(thin & thick) of IS 4163 latest issuance & material shall be free from slag inclusions. The same shall be reported along with every batch of supplies.	NABL LAB REPORT/ MILL TC	P	R
7		MACRO EXAMINATION	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random conditions & centre segregations exceeding severity levels of S-2 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3)Thermal defects such as burnt structure excessive grain growth (Coarser than grain size 5)grain boundary oxide & sulphide films, graphitisation & pitted surface are not permitted 4) Dendrites shall not be permitted beyond one third radius from the centre	NABL LAB REPORT/ MILL TC	P	R

EM DIVISION	QUALITY ASSURANCE PLAN		Sheet No: 3 of 4
	MODEL		DOC No.	QAP/C1212 RM
	PART NAME	C1212 ROUND	ISSUE No.	01
	PART NUMBER	C121208/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
8	HOT ROLLED BARS& OPEN FREE FORGED BARS	JOMINY HARDENABILITY	JOMINY (TEST AS PER IS3448 -1981)	ONE SPECIMEN PER HEAT	The Jominy end quench values shall be ensured (TEST AS PER IS3848 -1981) as follows Distance from quench end in mm / Hardness limits: Min / Max 1.5: 53 / 60 7.0: 51 / 59 9.0: 50 / 59 13: 46 / 57 20: 38 / 55 25: 35 / 53 50: 30 / 45	NABL LAB REPORT/ MILL TC	P	R
9		DIMENSIONS & TOLERANCES	MEASUREMENT	100 % ON ALL BARS	Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances	DIMENSION CHECK SHEET	P	R
10		STRAIGHTNESS	MEASUREMENT	100 % ON ALL BARS	The permissible deviation shall not exceed 3 mm in any 1000 mm length	DIMENSION CHECK SHEET	P	R
11		VISUAL EXAMINATION	Visual	100 % ON ALL BARS	Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust	TEST REPORT	P	R

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 4
	MODEL		DOC No.	QAP/C1212 RM
	PART NAME	C1212 ROUND	ISSUE No.	01
	PART NUMBER	C121208/09	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
12	HOT ROLLED BARS& OPEN FREE FORGED BARS	MARKING	VISUAL	100 % ON ALL BARS	All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.	--	P	R

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL
2 ~ 50	8	1.5%
51 ~ 90	13	1.0%
91~150	20	0.65%
151~280	32	0.40%
281~500	50	0.25%
501~1200	80	0.15%
1201~3200	125	0.10%
3201~10000	200	0.065%

P - Perform the Activity
W - Witnessing of Activity
R - Reviewing of QA Report
A – Audit check the activity

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

EM DIVISION	**QUALITY ASSURANCE PLAN**		**Sheet No: 1 of 4**
	MODEL		DOC No.	**QAP/C1215 RM**
	PART NAME	**C1215 ROUND**	ISSUE No.	**01**
	PART NUMBER	**C121508**	DATE	**05/08/2024**

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
1	HOT ROLLED BARS	MANUFACTURING ROUTE	MILL TC	--	Hot rolling process reduction from higher diameter to the required size. The steel shall be of Fully Killed Type.	MILL TC	P	R
2		SUPPLY CONDITION	METALLOGRAPHY / HT CYCLE	--	Round bars shall be supplied in Normalized condition with hardness of 255 BHN Max	HT cycle report/ hardness report	P	R
3		CHEMICAL COMPOSITION	CHEMICAL ANALYSIS (SPECTROMETER/ WET ANALYSIS)	One sample/ heat /cast batch	One sample per heat/cast batch shall be checked for chemical composition and shall conform to the company standard C1215 as below as mentioned in & reports to be submitted along with supply	MILL TC/ LAB REPORT	P	R

Elements	Requirement
C	0.40/0.45
Si	0.15/0.30
Mn	0.75/1.00
S	0.04 Max
P	0.025 Max
Cr	0.80/1.10
Mo	0.15/0.25
Cu	0.35 Max
Ni	0.25 Max
B	0.0003 Max

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 2 of 4
	MODEL		DOC No.	QAP/C1215 RM
	PART NAME	C1215 ROUND	ISSUE No.	01
	PART NUMBER	C121508	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML
4	HOT ROLLED BARS	REDUCTION RATIO	MILL TC		Bars up to 80 mm diameter shall have reduction ratio of 6:1 minimum & Bars above 80 mm shall have a reduction ratio of 4:1 minimum	MILL TC	P	R
5		GRAIN SIZE	METALLOGRAPHY	ONE SPECIMEN PER HEAT	Grain size of the material shall be austenitic grain size ASTM No: 5 or finer as per SAE J 418	NABL LAB REPORT/ MILL TC	P	R
6		INCLUSION RATING	METALLOGRAPHY	ONE SPECIMEN PER HEAT	1)Non metallic Inclusions rating (Sulphides, Alumina, silicates or globular oxides) rating shall be less than severity level 2.5(thin & thick) of IS 4163 latest 2) for vacuum treated /vacuum degases steels , the inclusion rating shall not exceed level 2.0(thin & thick) of IS 4163 latest 3)The metallic inclusion of both thin & thick type of maximum permissible severity(as above)occurring together is not permissible 4)Slag & dross are not permitted	NABL LAB REPORT/ MILL TC	P	R
7		MACRO EXAMINATION	MACRO ANALYSIS HOT ETCHING	ONE SPECIMEN PER HEAT	1)The bars shall not have subsurface conditions, random, conditions & centre segregations exceeding severity levels of S-2 R-3 and C-3 respectively (ref 1 Plate-I of ASTM E 381) 2) Flute cracks, Gassy , butty tears, splash, flakes and pattern shall not be permitted to any degree(ref 1 Plate-II of ASTM E 381) 3) Dendrites shall not be permitted beyond half radius from centre	NABL LAB REPORT/ MILL TC	P	R

EM DIVISION	**QUALITY ASSURANCE PLAN**		**Sheet No: 3 of 4**
	MODEL		DOC No.	**QAP/C1215 RM**
	PART NAME	**C1215 ROUND**	ISSUE No.	**01**
	PART NUMBER	**C121508**	DATE	**05/08/2024**

<table>
<tr><th rowspan="2">Sl. No.</th><th rowspan="2">Components / Operation</th><th rowspan="2">Characteristics to be assessed</th><th rowspan="2">Type / method of Check</th><th rowspan="2">Quantum of Check</th><th rowspan="2">Reference Standards or Documents</th><th rowspan="2">Acceptance Norms</th><th>Format of records</th><th>Inspection scope</th></tr>
<tr><th>Supplier</th><th>BEML</th></tr>
<tr><td>8</td><td>HOT ROLLED BARS</td><td>JOMINY HARDENABILITY</td><td>JOMINY (TEST AS PER IS3448 -1981)</td><td>ONE SPECIMEN PER HEAT</td><td>The Jominy end quench values shall be ensured (TEST AS PER IS3848 -1981) as follows
<table>
<tr><th>Distance from quench end in mm</th><th colspan="2">Hardness limits</th></tr>
<tr><th></th><th>Min</th><th>Max</th></tr>
<tr><td>1.5</td><td>56</td><td>61</td></tr>
<tr><td>7.0</td><td>55</td><td>60</td></tr>
<tr><td>20</td><td>48</td><td>56</td></tr>
<tr><td>30</td><td>41</td><td>52</td></tr>
<tr><td>40</td><td>38</td><td>48</td></tr>
</table></td><td>NABL LAB REPORT/ MILL TC</td><td>P</td><td>R</td></tr>
<tr><td>9</td><td></td><td>DIMENSIONS & TOLERANCES</td><td>MEASUREMENT</td><td>100 % ON ALL BARS</td><td>Permissible deviation in size for round bars shall be as per Grade II of IS 3739 latest issuances</td><td>DIMENSION CHECK SHEET</td><td>P</td><td>R</td></tr>
<tr><td>10</td><td></td><td>STRAIGHTNESS</td><td>MEASUREMENT</td><td>100 % ON ALL BARS</td><td>The permissible deviation shall not exceed 3 mm in any 1000 mm length</td><td>DIMENSION CHECK SHEET</td><td>P</td><td>R</td></tr>
<tr><td>11</td><td></td><td>VISUAL EXAMINATION</td><td>Visual</td><td>100 % ON ALL BARS</td><td>Material shall be free from defects such as lamination, crabs, cracks, severe alloy segregations Mill scale & rust</td><td>TEST REPORT</td><td>P</td><td>R</td></tr>
<tr><td>12</td><td></td><td>MARKING</td><td>VISUAL</td><td>100 % ON ALL BARS</td><td>All material in each consignment shall be suitably marked to identify the supplier, material grade, size & length.</td><td>--</td><td>P</td><td>R</td></tr>
</table>

EM DIVISION	QUALITY ASSURANCE PLAN			Sheet No: 4 of 4
	MODEL		DOC No.	QAP/C1215 RM
	PART NAME	C1215 ROUND	ISSUE No.	01
	PART NUMBER	C121508	DATE	05/08/2024

Sl. No.	Components / Operation	Characteristics to be assessed	Type / method of Check	Quantum of Check	Reference Standards or Documents	Acceptance Norms	Format of records	Inspection scope
							Supplier	BEML

Note: Sampling Plan: As per IS: 2500- 2000, Part 1, Level -II. Details mentioned in below.

Lot Size in Nos.	Sample Size in Nos.	AQL	
2 ~ 50	8	1.5%	**P - Perform the Activity** **W - Witnessing of Activity** **R - Reviewing of QA Report** **A – Audit check the activity**
51 ~ 90	13	1.0%	
91~150	20	0.65%	
151~280	32	0.40%	
281~500	50	0.25%	
501~1200	80	0.15%	
1201~3200	125	0.10%	
3201~10000	200	0.065%	

Prepared By :	Checked By :	Reviewed By :	Approved By :
C.VASANTHAKUMAR Sr. Manager – Receiving Quality	MAHESH KULKARNI DGM – Receiving Quality		Chief of Quality Engineering

Revised Std: Received on 5/5/93

1. SCOPE : This standard covers the requirements for Boron Steel used for machine structures.

2. MANUFACTURE :

The steel shall be of killed type.

3. CONDITION OF SUPPLY :

Rolled stock above 12mm rolling section (thickness or dia) shall be supplied in normalised condition.

4. FREEDOM FROM DEFECTS :

The material shall be free from internal and surface defects such as Laminations, scabs, cracks, Severe alloy segregation, Millscale and rust.

5. CHEMICAL COMPOSITION (WEIGHT %):
(As per Check Analysis)

5.1 CONSTITUENTS :

ELEMENT	% WEIGHT
Carbon	0.32 to 0.37
Silicon	0.15 to 0.35
Manganese	1.20 to 1.50
Sulphur, max.	0.030
Phosphorus. max.	0.030
Chromium, max.	0.20
Nickel. max.	0.25
Molybdenum, max.	0.05
Boron, min.	0.0005
Nickel + Chromium, max	0.30

5.2 Elements not specified above shall not be added to this steel, except for the purpose of finishing.

UNIT STANDARDS

KGF COMPLEX...

TITLE: BORON STEEL, GRADE-1

6. HARDENABILITY :

The following Jominey End Quench Hardenability values shall be ensured (Test as per IS:3848-1981) :

'J' Distance in mm	Hardness Limits HRC Max.	Min.
1.5	56	51
15.0	52.5	32
25.0	36	18

7. GRAIN SIZE : The grain size of material shall be in the range of ASTM grain size No.5 to 8 (or equivalent size no. as per IS:2853-1964).

8. INCLUSION RATING :

8.1 Unless otherwise specified, the Non-metallic Inclusions(Sulphides,Silicates,Globular Oxides and Alumina)Rating shall be less than Severity 3 (Thin and Thick series) of IS:4163-1982.

8.2 The material shall be free from slag inclusions.

9. CORROSION PROTECTION :

Material shall be delivered in a corrosion-free condition.

10. TEST CERTIFICATE :

Test Certificate shall be furnished by suppliers for each supply, with the following information :

a) Despatch Advice Number
b) Challan Number
c) Heat Number
d) Chemical Analysis of each item and heat
e) Non-destructive tests conducted and test results
f) Details of Heat-treatment conducted
g) Details of Metallurgical testing and results

11. MARKING :

Each consignment shall be suitably marked to identify the supplier, material, size and heat number, at supplier's cost.

30 OCT 1994

KES	BORON STEELS FOR MACHINE STRUCTURAL USE	7 MATERIALS) 216.1 (1988)

1. SCOPE This standard shall specify the production method, quality, test inspection, acceptance test and purchasing specification of the boron steels for machine structural use (hereinafter referred to as the steels), which are produced by hot-rolling or by forging (extending) and normally subjected to such fabrication as cutting, machining, etc. as well as to the heat treatment.

2. PRODUCTION METHOD

2.1 Steels shall be manufactured from killed steel ingots or continuous casting that has received electro-magnetic stirring.

There is no particular specification for steel furnaces, but the method of producing steel and ingots for the steel used in main parts must be checked. If the type of furnace or method of producting ingots is changed, the quality shall be checked and shall be determined in consultation with the steel manufacturer.

2.2 Forming ratio by forging from the steel ingots shall be 7S minimum. When the steels are used after further application of forging, the ratio may be 4S minimum. In any cases other than that mentioned above, the ratio shall be determined after consultation with a steel manufacturer.

2.3 In case of no special specifications, used steels shall be as rolled or as forged rolled.

3. QUALITIES

3.1 Kinds and chemical components. Conforming to table 1.

Table 1

Kinds	Symbols	Former symbols (reference)	Chemical components %								Applicable parts
			C	Si	Mn	P	S	Cr	Mo	B	
Boron steels	※ S35BCH	1035B S33BCH	0.32 ~0.37	0.15 ~0.30	0.70 ~1.00	0.030 max.	0.030 max.	0.20 以下	—	0.0005 min.	Bolt-shaft
	※ S43BCH	—	0.43 ~0.49	0.15 ~0.35	0.50 ~0.90						Pin
	※ (S45BCH)	1045B	0.43 ~0.48	0.15 ~0.30	0.60 ~0.90						
Manganese-Boron steels	※ SMnB427H	SMnB-1H 1027B	0.25 ~0.30	0.15 ~0.35	1.35 ~1.65			0.35 max.			Shaft
	※ SMnB430H	SMnB-2H SMnB	0.27 ~0.33		1.20 ~1.50						Track shoe
	※ SMnB435H	SMnB-3H 1036B SMn36BCH	0.32 ~0.37								Sprocket teeth-pin-shaft
Chromium-Boron steels	※ SCrB430H	—	0.28 ~0.33		0.80 ~1.10			0.90 ~1.20			Shank
	※ SCrB435H	—	0.32 ~0.39		0.85 ~1.05			0.90 ~1.05			Link

07.216.1
(1988)

Table 1 (2)

Kinds	Symbols	Former symbols (reference)	Chemical components %								Applicable parts
			C	Si	Mn	P	S	Cr	Mo	B	
Manganese·Chromium·Boron steels	※ SMnCB430H	—	0.28 ~0.33	0.15 ~0.35	1.20 ~1.50	0.030 max.	0.030 max.	0.40 ~0.60	—	0.0005 min.	Shoe
Chromium·Molybdenum·Boron steels	※ SCMB427H	SCM27B	0.25 ~0.30		0.90 ~1.20			0.75 ~1.05	0.15 ~0.30		Bolt
	※ SCMB445H	AK-2 AK-2M	0.41 ~0.47	0.60 ~0.80	0.40 ~0.60			0.40 ~0.70	0.08 ~0.20		Track roller
Manganese·Chromium molybdenum steels	※ SMnCrMoB 435H	SMnCrMoB-2H SCM435R	0.33 ~0.38	0.15 ~0.35	1.10 ~1.40			0.45 ~0.65	0.10 ~0.15		

※ Symbols with this mark shall be peculiar to KES and not specified in JIS.

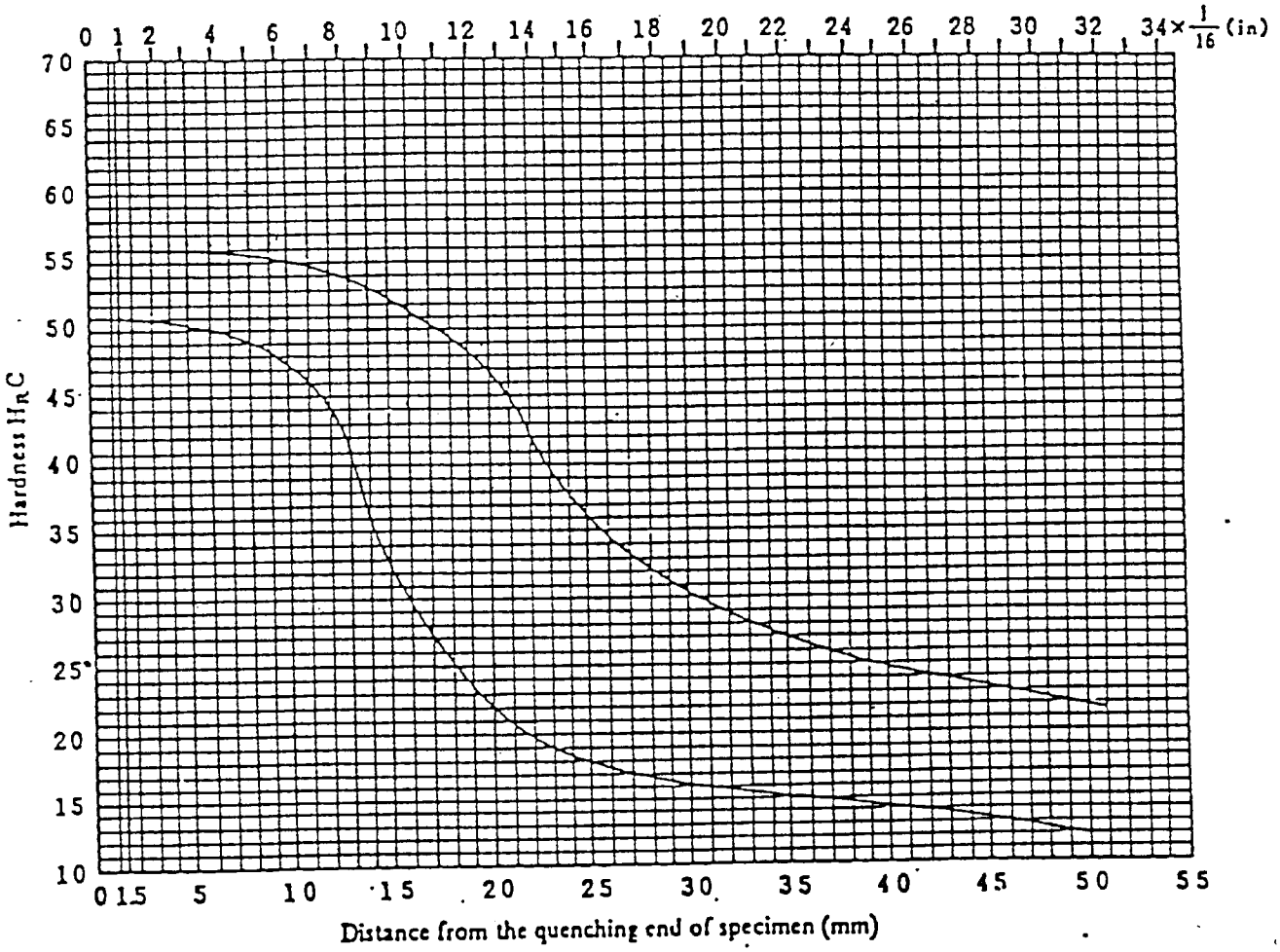
Reference

1. For all kinds, impurities shall be Cu<0.30%.
2. For Boron steels, impurities shall be Ni<0.20%, Cr≦0.20%, Ni+Cr<0.30%.
3. For steels other than Boron steels, impurities shall be Ni<0.25%.
4. For Manganese·Boron steels, impurities shall be Cr≦0.35%.
5. By using water to quench S35BCH and SMnB435H, it is possible to use it as a substitute steel for small particle and large particle SMnC443H or SCM435H respectively. However, to prevent deformation, consult with the heat treatment department.
6. SCrB430H, SCrB435H, and SMnB430H have each been developed as a substitute steel for SCM430H and SCM435H respectively.

07.216.1
(1988)

Attached fig. 6 Hardenability of SMnB435H

Hardness HRC \ Distance from the quenching end and its hardness mm	1.5	3	5	7	9	11	13	15	20	25	30	35	40	45	50	Heat treatment temperature °C: Normalizing	Heat treatment temperature °C: Quenching
Upper limit	56	56	56	55.5	55	54.5	53.5	52.5	47	36	30	27	25	23.5	22	870	845
Lower limit	51	50.5	50	49.5	48	46	40	32	21	18	16	15	14	13	12		



BOHLER UDDEHOLM
AUSTRALIA

EN39B Case hardening steel

Typical Analysis (Ave. values %)	C	Si	Mn	Ni	Cr	Mo	S	P
	0.15	0.25	0.4	4.2	1.2	0.25	0.025	0.025

NEAREST STANDARD	AS	DIN	BS
	X9315	1.6723	835 M 15

DESCRIPTION	4¼% Nickel Chromium Molybdenum case hardening steel for large and highly stressed applications.

APPLICATIONS	Components with large cross sections requiring very high toughness and core strength (1300 MPa) such as gears, gear shafts and heavy duty gear shafts in aircraft, truck construction and mechanical engineering.

MECHANICAL PROPERTIES Heat Treated Condition	Tensile Strength MPa	Elong. %	Izod Impact J	Brinell Hardness Annealed
	1310	12	33	277 max

HEAT TREATMENT		
	Forge	850-1050°C. Cool in furnace.
	Normalize	850-880°C. Air cool.
	Anneal	650-700°C. Cool slowly in controlled furnace.
	Carburize	880-930°C. Furnace or Air cool
	Core Refine	850-880°C. Oil quench or Air cool.
	Harden	760-780°C Oil quench.
	Temper	180-200°C air cool

WELDING	Parts should be welded before Carburizing and Hardening. Preheat to 250-350°C. Filler metals:-Bohler FOX DCMS-KB or FOX 2.5 Ni electrodes. DCMS-IG wire.

SIZE RANGE	Round	42-142 mm

BOHLER UDDEHOLM
AUSTRALIA

LOCATIONS

Bohler Uddeholm Australia Pty Ltd ABN 15000013052

Sydney	129-135 McCredie Rd Guildford	2161	Ph (02) 8724 5554	Fax (02) 8724 5555
Newcastle	3 Pavilion Pl Cardiff	2285	Ph (02) 4954 6611	Fax (02) 4956 5773
Albury	1 Eames St Albury	2640	Ph (02) 6041 3399	Fax (02) 6041 1820
Wollongong	40 Doyle Ave Unanderra	2526	Ph (02) 4272 6544	Fax (02) 4272 7563
Marayong	1/21 Binney Rd Marayong	2148	Ph (02) 9831 4431	Fax (02) 9671 1682
Melbourne	282-290 Greens Rd Dandenong	3175	Ph (03) 9767 5554	Fax (03) 9767 5555
Bayswater	4 Amsted Rd Bayswater	3153	Ph (03) 9739 8022	Fax (03) 9739 8033
Adelaide	1 Williams Cir Pooraka	5095	Ph (08) 8368 4554	Fax (08) 8368 4555
Brisbane	12-18 Limestone St Darra	4076	Ph (07) 3712 9554	Fax (07) 3712 9555
Townsville	9-11 Caldwell St Garbutt	4814	Ph (07) 4479 4800	Fax (07) 4725 1316
Perth	29-33 Gauge Cir Canningvale	6155	Ph (08) 9455 8672	Fax (08) 9455 8673
Kewdale	5 Beete St Welshpool	6106	Ph (08) 9350 9582	Fax (08) 9350 9683
Launceston	20 Murphy St Invermay	7248	Ph (03) 6334 3542	Fax (03) 6331 4001

www.buau.com.au

Notes

QUALITY PLAN FOR LW 4130H / SAE 4130H VD TUBES

बी ई एम एल
beml

DOC NO : HP-QH-REC-QP-RM-014 /Rev 00 Dtd 13.08.2024

Sl No	Description / Component	Characteristics / Parameters / Type of check	Quantum of Check	Testing Standards	Accepted standards / Specs	Format of Record	Inspection	
							M	BEML
1	Raw Material	Mill TC	100%	-	Ingot Cast / Continuous Cast and Hot Rolled, Hot finished or Forged Condition	Mill TC	P	V
2	Material Composition	Chemistry	1/Heat	Standard	LW 4130H / SAE 4130H VD	NABL Report / Mill TC	P	V / P
3	Delivery Condition	Heat Treatment	100%	Standard	Normalised Condition	Mill TC	P	V
4	Micro Examination	Jominy hardenability	1/Heat	ASTM A255	27~42 RC @ J 8/16	NABL Report / Mill TC	P	V
		Grain Size	1/Heat	standard	MCQuaid-EHN, Sixe 5~8 fine grain as per ASTM E112.	NABL Report / Mill TC	P	V
5	Surface condition	Visual Inspection	100%	Standard	Free from flaws, cracks, uncleared patches, bends, burrs, sharp edges and any other visual defects.	Visual Report	P	V
6	Dimensions	Measure	100%	Standard	Size Tolerance: ±2mm on OD Wall Thickness:±10%	Check sheet	P	P
7	Preservation	Surface Coating	100%	Standard	Tubes should supply along with rust preventive oil at inner and outer surface and tube ends should be closed with suitable end caps to prevent igress of foreign material	-	P	V
8	Identification Marks	Visual Inspection	100%	-	Part number, Heat Number, Material, Vendor code shall be provided on item.	-	P	V

LEGEND - M -Manufacturer, P - Perform, V- Verification of documents, A- Audit checking, *- If applicable

TABLE 1 (Ref: IS 2500-Part 1:2000)		
LOT SIZE	Inspection level I	SAMPLE SIZE
2 ~ 90	C	5
91~150	D	8
151~280	E	13
281~500	F	20
501~1200	G	32
1201~3200	H	50
3201~10000	J	80

Note:

1) This Quality plan will applicable only for all LW4130H / SAE 4130H VD tubes only

2) Warranty /Guarantee certificate shall be provided as per terms & conditions of Purchase order

Prepared by
Harika Reddy A
13/08/2024

Reviewed by
Dinesh G
13/8/2024

Approved by
Gopinath M
Asst. General Manager
QA Dept. H&P Division
BEML Limited
Kolar Gold Fields - 563 115

QUALITY PLAN FOR C1209 ROUNDS

DOC NO : HP-QH-REC-QP-RM-010 /Rev 00 Dtd 13.11.2023

Sl No	Description / Component	Characteristics / Parameters / Type of check	Quantum of Check	Testing Standards	Accepted standards / Specs	Format of Record	Inspection	
							M	BEML
1	Material	Composition	1/Heat	Standard / TDC	C1209-08 / SAE4135H VD /En 19 of BS 970	NABL Report	P	V / P
2	Delivery Condition	Heat Treatment	100%	Standard / TDC	Normalised Condition	HT Record	P	V
3	Mechanical Properties in normalised Condition	Tensile, Yield strength & Hardness	1/ Heat	Standard / TDC	Tensile Strength -800N/mm2(min) Yield Strength -540N/mm2(min) Hardness: 180~229 BHN	NABL Report	P	V
		Reduction Ratio	1/ Heat	Standard / TDC	Rods upto Ø80mm: 6:1 minimum Rods >Ø80mm: 4:1 minimum	Mill TC	P	V
4	Metallographic Properties	Inclusion Rating	1/ Heat	Standard / TDC	1 no. sample shall be checked for inclusion rating and report to be sent along with each consignment as per IS :4163-1982.Type A-B-C-D for both Thin & Thick 2.5max.	NABL Report	P	V
		Grain Size	1/ Heat	Standard / TDC	Grain Size -5 to 8(or equivalent as per IS:2853-1964 &ASTM E-112)	Mill TC	P	V
5	Hardenability	Measure	1/ Heat	Standard / TDC	Hardenability values shall be reported. Test as per IS:3448-1981.	NABL Report	P	V
6	Macro Examination	Measure	1/ Heat	Standard / TDC	Bars shall not have Sub surface conditions, Random conditions and Centre segregation exceeding severely levels of C3,R3, S3 as per ASTME381 Dendrites shall not be permitted beyond half radius from center.	NABL Report	P	V
7	NDT	Measure	100%	Standard / TDC	100% on all the rounds to meet ASTM A609 - 4mm FBH.	UT Report	P	V
8	Surface condition	Visual Inspection	100%	Standard / TDC	Free from flute cracks, Gassy, Butt tears, splash, flakes and any other visual defects.	Visual Report	P	A
9	Dimensions	Measure	100%	Standard / TDC	Shall confirm to standard / TDC requirements. Permissible deviation in straightness shall not exceed 3mm / 1000mm length.	Check sheet	P	P

Prepared by
Harika Reddy A

Reviewed by
Dinesh G

GANAPATI BHAT KOTI
Deputy General Manager
QA Dept. H & P Division
BEML Limited
Kolar Gold Fields - 563 115

Approved by
Ganapati Bhat

Sl No	Description / Component	Characteristics / Parameters / Type of check	Quantum of Check	Testing Standards	Accepted standards / Specs	Format of Record	Inspection	
							M	BEML
10	Identification Marks	Visual Inspection	100%	Standard / TDC	Part number, Heat Number, Material, Vendor code shall be provided on item. BEML Colour coding [Yellow-Brown-Al White] at both ends as per PR1002-C	-	P	V

LEGEND - M -Manufacturer, P - Perform, V- Verification of documents, A- Audit checking, *- If applicable

TABLE 1 (Ref: IS 2500-Part 1:2000)		
LOT SIZE	General Inspection level I	SAMPLE SIZE
2 ~ 90	C	5
91~150	D	8
151~280	E	13
281~500	F	20
501~1200	G	32
1201~3200	H	50
3201~10000	J	80

Note:

1) This Quality plan will applicable only for all C1209 Material Rounds

2) Warranty /Guarantee certificate shall be provided as per terms & conditions of Purchase order

Prepared by
Harika Reddy A

Reviewed by
Dinesh G

GANAPATI BHAT KOTI
Deputy General Manager
QA Dept. H & P Division
BEML Limited
Kolar Gold Fields - 563 115

Approved by
Ganapati Bhat

Form-MA - Manufacturer's Authorization Form

[The Bidder shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are legally binding on the Manufacturer.]

Date: *[insert date (as day, month and year) of Bid Submission]*

BID No.: *[insert number of bidding process]*

Alternative No.: *[insert identification No if this is a Bid for an alternative]*

To:

[insert complete name of Purchaser]

WHEREAS

We *[insert complete name of Manufacturer]*, who are official manufacturers of *[insert type of goods manufactured]*, having factories at [insert full address of Manufacturer's factories], do hereby authorize *[insert complete name of Bidder]* to submit a bid the purpose of which is to provide the following Goods, manufactured by us *[insert name and or brief description of the Goods]*, and to subsequently negotiate and sign the Contract against the Bid Document.

We hereby extend our full guarantee and warranty in accordance with Warrant Clause of the terms & Conditions of Contract, with respect to the Goods offered by the above firm against this BID. We as a manufacturer of *[insert type of goods manufactured]* confirm to provide the spare & service support for a minimum period of 5 years after commissioning

Signed: *[insert signature(s) of authorized representative(s) of the Manufacturer]*

Name: *[insert complete name(s) of authorized representative(s) of the Manufacturer]*

Title: *[insert title]*

Duly authorized to sign this Authorization on behalf of: *[insert complete name of Bidder]*

Dated on_____day of _____,_____*[insert date of signing]*

Note – Modify this format suitably in cases where manufacturer's warranty and guarantee are not applicable for the items for which bids are invited. If the supply consists of number of items, indicate the specific item (s) for which alone the above authorization is required.

Mandated Enclosure: UDYAM Certificate of Manufacturer/OEM/support document to be an OEM.

Annexure III

Compliance certificate

Bidders having beneficial ownership in countries which share land border with India

I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the competent Authority.

II. " Bidder " (including the term ' tenderer ' , consultant ' or service provider ' in certain contexts) means any person or firm or company , including any member of a consortium or joint venture (that is an association of several persons, or firms or companies) every artificial juridical person not falling in any of the descriptions of bidders stated here in before , including any agency branch or office controlled by such person , participating in a process.

III. "Bidder from a country which shares a land border with India " for the purpose of this order means : -

   a. An entity incorporated , established or registered in such country ;or
   b. A subsidiary of an entity incorporated, established or registered in such a country ;or
   c. An entity substantially controlled through entities incorporated, established or registered in such a country ; or
   d. An entity whose beneficial owner is situated in such a country ; or
   e. An Indian (or other) agent of such an entity ; or
   f. A natural person who is a citizen of such a country ; or
   g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above.

IV. The beneficial owner for the purpose of (iii) above will be as under :

   1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s) , who , whether acting alone or together , or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.
      a. " Controlling ownership interest " means ownership of or entitlement to more than twenty-five per cent of shares or capital or profits of the company
      b. " Control " shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreement s or voting agreements;
   2. In case of a partnership firm , the beneficial owner is the natural person(s) who , whether acting alone or together , or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;
   3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who , whether acting alone or together , or through one or more juridical person , has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official.
5. In case of a trust , the identification of beneficial owner(s) shall include identification of the author of the trust , the trustee , the beneficiaries with fifteen percent or more interest in the trust an any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V An agent is a person employed to do any act for another, or to represent another in dealings with third person.

VI The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the competent Authority.

I/we have read the clause regarding above terms and conditions regarding restrictions on procurement whether goods, services (including consultancy service and non consultancy services) or works (including turn key projects)

I / We M/s …….(Name of the bidder) are not from a country which shares land border with India and as per the above terms and conditions are eligible to participate in this tender.

Or

I / We M/s …….(Name of the bidder) are from a country which shares land border with India and as per the above terms and conditions ,we are registered with Competent authority with Registration no ……..are eligible to participate in this tender.

[Format for seeking registration for bidders having beneficial ownership in countries which share land border with India and further details refer Notification no P-45021/112/2020-PP (BE-II) (E-43780) dated 14.10.2020 Department of promotion of industry and internal trade , Ministry of Commerce and Industry , Govt. of India .]

(Signature of authorized signatory of the tenderer)

Name:

Designation:

Place Seal :

Date:

No. DPE/7(4)/2017-Fin.(Part-I)
Government of India
Ministry of Heavy Industries& Public Enterprises
Department of Public Enterprises
*****

Public Enterprises Bhawan
Block No.14, CGO Complex
New Delhi – 110003

Date: 30th July, 2020

OFFICE MEMORANDUM

Subject: Restrictions under Rule 144(xi) of the General Financial Rules (GFRs),2017- Dept. of Expenditure OM No.6/18/2019-PPD dated 23rd July, 2020 - regarding

The undersigned is directed to enclose Department of Expenditure's (DoE) OMs No. 6/18/2019-PPD dated 23rd July, 2020 & 24th July, 2020 imposing restrictions under Rule 144(xi) of the General Financial Rules (GFRs), 2017 on the grounds of Defence of India and National Security for information and compliance.

2. All the administrative Ministries/ Departments of CPSEs are requested to ensure compliance of the directions issued by DoE by CPSEs under their administrative control.

3. This issues with the approval of competent authority.

K. Mishra

(Kalyani Mishra)
Director
Tel.24362061

Encl.: (DoE's OMs No. 6/18/2019-PPD dated 23rd July, 2020
6/18/2019-PPD dated 23rd July, 2020&
6/18/2019-PPD dated 24th July, 2020)

To
i) All the Secretaries to the Administrative Ministries/Departments of CPSEs
ii) Chief Executives of CPSEs

Copy for information to:
Secretary, D/o Expenditure, North Block, New Delhi

डा. टी. वी. सोमनाथन, आई.ए.एस.
सचिव (व्यय)
Dr. T. V. Somanathan, I.A.S.
Secretary (Expenditure)

सत्यमेव जयते

भारत सरकार
वित्त मंत्रालय
व्यय विभाग
Government of India
Ministry of Finance
Department of Expenditure
नार्थ ब्लाक, नई दिल्ली-110001
North Block, New Delhi-110001
Tel. : 23092929, 23092663
Fax : 23092546
E-mail : secyexp@nic.in
Website : www.finmin.nic.in

स्वच्छ भारत
एक कदम स्वच्छता की ओर

D.O.F.No.6/18/2019- PPD

28th July, 2020

47545
29/7/20

Dear Shri Sailesh,

As you are aware the General Financial Rules (GFRs), 2017 have been amended inserting Rule 144 (xi) which empowers Department of Expenditure to impose restrictions, including prior registration or screening on procurement from bidders from a country or countries on grounds of Defence of India and National Security. The amended Rule provides that no public procurement shall be made in violation of such restrictions. Pursuant to the above, Order (Public Procurement No. 1) and Order (Public Procurement No. 2) were issued vide F.No.6/18/2019-PPD dated 23.7.2020. A clarification was issued in Order (Public Procurement No. 3).

2. Though the GFRs ordinarily do not apply to public sector enterprises, in this instance, as they relate to national security, the orders have consciously been made applicable to all Central Public Sector Enterprises as well. It is, therefore, requested that necessary instructions may be issued by your Department reiterating the applicability of orders stated in Paragraph 1 of this letter to all Central Public Sector Enterprises.

3. Copies of the Orders are attached for ease of reference.

With regards,

Yours sincerely,

(T.V. Somanathan)

AS(RKC)

Encl: **As above**

Shri Sailesh, IAS
Secretary,
Department of Public Enterprises,
160, Udyog Bhawan,
New Delhi: 110011

Copy to: Cabinet Secretary – for information

We may issue instructions today
29/7

F.No.6/18/2019-PPD
Ministry of Finance
Department of Expenditure
Public Procurement Division

161, North Block,
New Delhi
23rd July, 2020

Office Memorandum

Subject: Insertion of Rule 144 (xi) in the General Financial Rules (GFRs), 2017

Rule 144 of the General Financial Rules 2017 entitled 'Fundamental principles of public buying', has been amended by inserting sub-rule (xi) as under:

Notwithstanding anything contained in these Rules, Department of Expenditure may, by order in writing, impose restrictions, including prior registration and/or screening, on procurement from bidders from a country or countries, or a class of countries, on grounds of defence of India, or matters directly or indirectly related thereto including national security; no procurement shall be made in violation of such restrictions.

(Sanjay Prasad)
Joint Secretary (PPD)
Email ID: js.pfc2.doe@gov.in
Telephone: 011-23093882

To,
(1) Secretaries of All Ministries/ Departments of Government of India
(2) Chief Secretaries/ Administrators of Union Territories/ National Capital Territory of Delhi

F.No.6/18/2019-PPD
Ministry of Finance
Department of Expenditure
Public Procurement Division

161, North Block,
New Delhi
23rd July, 2020

Order (Public Procurement No. 1)

Subject: Restrictions under Rule 144 (xi) of the General Financial Rules (GFRs), 2017

Attention is invited to this office OM no. 6/18/2019-PPD dated 23rd July 2020 inserting Rule 144 (xi) in GFRs 2017. In this regard, the following is hereby ordered under Rule 144 (xi) on the grounds stated therein:

Requirement of registration

1. Any bidder from a country which shares a land border with India will be eligible to bid in any procurement whether of goods, services (including consultancy services and non-consultancy services) or works (including turnkey projects) only if the bidder is registered with the Competent Authority, specified in **Annex I.**

2. This Order shall not apply to (i) cases where orders have been placed or contract has been concluded or letter/notice of award/ acceptance (LoA) has been issued on or before the date of this order; and (ii) cases falling under **Annex II**.

Transitional cases

3. Tenders where no contract has been concluded or no LoA has been issued so far shall be handled in the following manner: -

    a) *In tenders which are yet to be opened, or where evaluation of technical bid or the first exclusionary qualificatory stage (i.e. the first stage at which the qualifications of tenderers are evaluated and unqualified bidders are excluded) has not been completed*: No contracts shall be placed on bidders from such countries. Tenders received from bidders from such countries shall be dealt with as if they are non-compliant with the tender conditions and the tender shall be processed accordingly.

    b) *If the tendering process has crossed the first exclusionary qualificatory stage*: If the qualified bidders include bidders from such countries, the

entire process shall be scrapped and initiated *de novo*. The *de novo* process shall adhere to the conditions prescribed in this Order.

c) As far as practicable, and in cases of doubt about whether a bidder falls under paragraph 1, a certificate shall be obtained from the bidder whose bid is proposed to be considered or accepted, in terms of paras 8, 9 and 10 read with para 1 of this Order.

Incorporation in tender conditions

4. In tenders to be issued after the date of this order, the provisions of paragraph 1 and of other relevant provisions of this Order shall be incorporated in the tender conditions.

Applicability

5. Apart from Ministries / Departments, attached and subordinate bodies, notwithstanding anything contained in Rule 1 of the GFRs 2017, this Order shall also be applicable
   a. to all Autonomous Bodies;
   b. to public sector banks and public sector financial institutions; and
   c. subject to any orders of the Department of Public Enterprises, to all Central Public Sector Enterprises; and
   d. to procurement in Public Private Partnership projects receiving financial support from the Government or public sector enterprises/ undertakings.
   e. Union Territories, National Capital Territory of Delhi and all agencies/ undertakings thereof

Definitions

6. "Bidder" for the purpose of this Order (including the term 'tenderer', 'consultant' 'vendor' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency, branch or office controlled by such person, participating in a procurement process.

7. "Tender" for the purpose of this Order will include other forms of procurement, except where the context requires otherwise.

8. "Bidder from a country which shares a land border with India" for the purpose of this Order means

a) An entity incorporated, established or registered in such a country; or
b) A subsidiary of an entity incorporated, established or registered in such a country; or
c) An entity substantially controlled through entities incorporated, established or registered in such a country; or
d) An entity whose *beneficial owner* is situated in such a country; or
e) An Indian (or other) agent of such an entity; or
f) A natural person who is a citizen of such a country; or
g) A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

9. "Beneficial owner" for the purpose of paragraph 8 above will be as under:

(i) In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person(s), has a controlling ownership interest or who exercises control through other means.
Explanation—

a. "Controlling ownership interest" means ownership of, or entitlement to, more than twenty-five per cent of shares or capital or profits of the company;

b. "Control" shall include the right to appoint the majority of the directors or to control the management or policy decisions, including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

(ii) In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

(iii) In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

(iv) Where no natural person is identified under (i) or (ii) or (iii) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

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(v) In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

10. "Agent" for the purpose of this Order is a person employed to do any act for another, or to represent another in dealings with third persons.

Sub-contracting in works contracts

11. In works contracts, including turnkey contracts, contractors shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority. The definition of "contractor from a country which shares a land border with India" shall be as in paragraph 8 above. This shall not apply to sub-contracts already awarded on or before the date of this Order.

Certificate regarding compliance

12. A certificate shall be taken from bidders in the tender documents regarding their compliance with this Order. If such certificate given by a bidder whose bid is accepted is found to be false, this would be a ground for immediate termination and further legal action in accordance with law.

Validity of registration

13. In respect of tenders, registration should be valid at the time of submission of bids and at the time of acceptance of bids. In respect of supply otherwise than by tender, registration should be valid at the time of placement of order. If the bidder was validly registered at the time of acceptance / placement of order, registration shall not be a relevant consideration during contract execution.

Government E-Marketplace

14. The Government E-Marketplace shall, as soon as possible, require all vendors/ bidders registered with GeM to give a certificate regarding compliance with this Order, and after the date fixed by it, shall remove non-compliant entities from GeM unless/ until they are registered in accordance with this Order.

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Model Clauses/ Certificates

15. Model Clauses and Model Certificates which may be inserted in tenders / obtained from Bidders are enclosed as **Annex III**. While adhering to the substance of the Order, procuring entities are free to appropriately modify the wording of these clauses based on their past experience, local needs etc. without making any reference to this Department.

(Sanjay Prasad)
Joint Secretary (PPD)
Email ID: js.pfc2.doe@gov.in
Telephone: 011-23093882

To

(1) Secretaries of All Ministries/ Departments of Government of India for information and necessary action. They are also requested to inform these provisions to all procuring entities.

(2) Secretary, Department of Public Enterprises with a request to immediately reiterate these orders in respect of Public Enterprises.

(3) Secretary DPIIT with a request to initiate action as provided under Annex I

(4) Chief Secretaries/ Administrators of Union Territories/ National Capital Territory of Delhi

6/12

Annex I: Competent Authority and Procedure for Registration

A. The Competent Authority for the purpose of registration under this Order shall be the Registration Committee constituted by the Department for Promotion of Industry and Internal Trade (DPIIT)*.

B. The Registration Committee shall have the following members*:

   i. An officer, not below the rank of Joint Secretary, designated for this purpose by DPIIT, who shall be the Chairman;
   ii. Officers (ordinarily not below the rank of Joint Secretary) representing the Ministry of Home Affairs, Ministry of External Affairs, and of those Departments whose sectors are covered by applications under consideration;
   iii. Any other officer whose presence is deemed necessary by the Chairman of the Committee.

C. DPIIT shall lay down the method of application, format etc. for such bidders as stated in para 1 of this Order.

D. On receipt of an application seeking registration from a bidder from a country covered by para 1 of this Order, the Competent Authority shall first seek political and security clearances from the Ministry of External Affairs and Ministry of Home Affairs, as per guidelines issued from time to time. Registration shall not be given unless political and security clearance have both been received.

E. The Ministry of External Affairs and Ministry of Home Affairs may issue guidelines for internal use regarding the procedure for scrutiny of such applications by them.

F. The decision of the Competent Authority, to register such bidder may be for all kinds of tenders or for a specified type(s) of goods or services, and may be for a specified or unspecified duration of time, as deemed fit. The decision of the Competent Authority shall be final.

G. Registration shall not be granted unless the representatives of the Ministries of Home Affairs and External Affairs on the Committee concur*.

H. Registration granted by the Competent Authority of the Government of India shall be valid not only for procurement by Central Government and its agencies/ public enterprises etc. but **also for procurement by State Governments and their agencies/ public enterprises etc. No fresh registration at the State level shall be required.**

7/12

I. The Competent Authority is empowered to cancel the registration already granted if it determines that there is sufficient cause. Such cancellation by itself, however, will not affect the execution of contracts already awarded. Pending cancellation, it may also suspend the registration of a bidder, and the bidder shall not be eligible to bid in any further tenders during the period of suspension.

J. For national security reasons, the Competent Authority shall not be required to give reasons for rejection / cancellation of registration of a bidder.

K. In transitional cases falling under para 3 of this Order, where it is felt that it will not be practicable to exclude bidders from a country which shares a land border with India, a reference seeking permission to consider such bidders shall be made by the procuring entity to the Competent Authority, giving full information and detailed reasons. The Competent Authority shall decide whether such bidders may be considered, and if so shall follow the procedure laid down in the above paras.

L. Periodic reports on the acceptance/ refusal of registration during the preceding period may be required to be sent to the Cabinet Secretariat. Details will be issued separately in due course by DPIIT.

[*Note:

i. In respect of application of this Order to procurement by/ under State Governments, all functions assigned to DPIIT shall be carried out by the State Government concerned through a specific department or authority designated by it. The composition of the Registration Committee shall be as decided by the State Government and paragraph G above shall not apply. However, the requirement of **political and security clearance as per para D shall remain and no registration shall be granted without such clearance**.

ii. Registration granted by State Governments shall be valid only for procurement by the State Government and its agencies/ public enterprises etc. and shall not be valid for procurement in other states or by the Government of India and their agencies/ public enterprises etc.]

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Annex II: Special Cases

A. Till 31st December 2020, procurement of medical supplies directly related to containment of the Covid-19 pandemic shall be exempt from the provisions of this Order.

B. *Bona fide* procurements made through GeM without knowing the country of the bidder till the date fixed by GeM for this purpose, shall not be invalidated by this Order.

C. *Bona fide* small procurements, made without knowing the country of the bidder, shall not be invalidated by this Order.

D. In projects which receive international funding with the approval of the Department of Economic Affairs (DEA), Ministry of Finance, the procurement guidelines applicable to the project shall normally be followed, notwithstanding anything contained in this Order and without reference to the Competent Authority. Exceptions to this shall be decided in consultation with DEA.

E. This Order shall not apply to procurement by Indian missions and by offices of government agencies/ undertakings located outside India.

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Annex III

Model Clause /Certificate to be inserted in tenders etc.

(While adhering to the substance of the Order, procuring entities and GeM are free to appropriately modify the wording of the clause/ certificate based on their past experience, local needs etc.)

Model Clauses for Tenders

I. Any bidder from a country which shares a land border with India will be eligible to bid in this tender only if the bidder is registered with the Competent Authority.

II. "Bidder" (including the term 'tenderer', 'consultant' or 'service provider' in certain contexts) means any person or firm or company, including any member of a consortium or joint venture (that is an association of several persons, or firms or companies), every artificial juridical person not falling in any of the descriptions of bidders stated hereinbefore, including any agency branch or office controlled by such person, participating in a procurement process.

III. "Bidder from a country which shares a land border with India" for the purpose of this Order means: -

a. An entity incorporated, established or registered in such a country; or
b. A subsidiary of an entity incorporated, established or registered in such a country; or
c. An entity substantially controlled through entities incorporated, established or registered in such a country; or
d. An entity whose *beneficial owner* is situated in such a country; or
e. An Indian (or other) agent of such an entity; or
f. A natural person who is a citizen of such a country; or
g. A consortium or joint venture where any member of the consortium or joint venture falls under any of the above

IV. The *beneficial owner* for the purpose of (iii) above will be as under:

1. In case of a company or Limited Liability Partnership, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has a controlling ownership interest or who exercises control through other means.
Explanation—

a. "Controlling ownership interest" means ownership of or entitlement to more than twenty-five per cent. of shares or capital or profits of the company;

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b. "Control" shall include the right to appoint majority of the directors or to control the management or policy decisions including by virtue of their shareholding or management rights or shareholders agreements or voting agreements;

2. In case of a partnership firm, the beneficial owner is the natural person(s) who, whether acting alone or together, or through one or more juridical person, has ownership of entitlement to more than fifteen percent of capital or profits of the partnership;

3. In case of an unincorporated association or body of individuals, the beneficial owner is the natural person(s), who, whether acting alone or together, or through one or more juridical person, has ownership of or entitlement to more than fifteen percent of the property or capital or profits of such association or body of individuals;

4. Where no natural person is identified under (1) or (2) or (3) above, the beneficial owner is the relevant natural person who holds the position of senior managing official;

5. In case of a trust, the identification of beneficial owner(s) shall include identification of the author of the trust, the trustee, the beneficiaries with fifteen percent or more interest in the trust and any other natural person exercising ultimate effective control over the trust through a chain of control or ownership.

V. An Agent is a person employed to do any act for another, or to represent another in dealings with third person.

VI. *[To be inserted in tenders for Works contracts, including Turnkey contracts]* The successful bidder shall not be allowed to sub-contract works to any contractor from a country which shares a land border with India unless such contractor is registered with the Competent Authority.

Model Certificate for Tenders (for transitional cases as stated in para 3 of this Order)

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I hereby certify that this bidder is not from such a country and is eligible to be considered."

Model Certificate for Tenders

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this bidder is not from such a country or, if from such a country, has been registered with the

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Competent Authority. I hereby certify that this bidder fulfills all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Model Certificate for Tenders for Works involving possibility of sub-contracting

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India and on sub-contracting to contractors from such countries; I certify that this bidder is not from such a country or, if from such a country, has been registered with the Competent Authority and will not sub-contract any work to a contractor from such countries unless such contractor is registered with the Competent Authority. I hereby certify that this bidder fulfills all requirements in this regard and is eligible to be considered. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

Model Certificate for GeM:

"I have read the clause regarding restrictions on procurement from a bidder of a country which shares a land border with India; I certify that this vendor/ bidder is not from such a country or, if from such a country, has been registered with the Competent Authority. I hereby certify that this vendor/ bidder fulfills all requirements in this regard and is eligible to be considered for procurement on GeM. [Where applicable, evidence of valid registration by the Competent Authority shall be attached.]"

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F.No.6/18/2019-PPD
Ministry of Finance
Department of Expenditure
Public Procurement Division

161, North Block
New Delhi
23rd July, 2020

Order (Public Procurement No. 2)

Subject: Exclusion from restrictions under Rule 144 (xi) of the General Financial Rules (GFRs), 2017 –regarding.

In Order (Public Procurement No. 1) dated 23rd July 2020, orders have been issued requiring registration of bidders from a country sharing a land border with India in order to be eligible to bid in public procurement.

2. Notwithstanding anything contained therein, it is hereby clarified that the said Order will not apply to bidders from those countries (even if sharing a land border with India) to which the Government of India has extended lines of credit or in which the Government of India is engaged in development projects.

3. Updated lists of countries to which lines of credit have been extended or in which development projects are undertaken are given in the website of the Ministry of External Affairs.

(Sanjay Prasad)
Joint Secretary (PPD)
Email ID: js.pfc2.doe@gov.in
Telephone: 011-23093882

To,

(1) Secretaries of All Ministries/ Departments of Government of India for information and necessary action. They are also requested to inform these provisions to all procuring entities.

(2) Secretary, Department of Public Enterprises with a request to immediately reiterate these orders in respect of Public Enterprises.

(3) Chief Secretaries/ Administrators of Union Territories/ National Capital Territory of Delhi

F.No.6/18/2019-PPD
Ministry of Finance
Department of Expenditure
Public Procurement Division

161, North Block,
New Delhi
24th July, 2020

Order (Public Procurement No. 3)

Subject: Clarification to Order (Public Procurement No.1) dated 23rd July 2020

Attention is invited to paragraph 3(b) of the Order (Public Procurement No.1), under the heading "Transitional provisions" which reads as follows:

> b) *If the tendering process has crossed the first exclusionary qualificatory stage*: If the qualified bidders include bidders from such countries, the entire process shall be scrapped and initiated *de novo*. The *de novo* process shall adhere to the conditions prescribed in this Order.

It is hereby clarified that for the purpose of paragraph 3 (b), "qualified bidders" means only those bidders who would otherwise have been qualified for award of the tender after considering all factors including price, if Order (Public Procurement No. 1) dated 23rd July 2020 had not been issued.

2. If bidders from such countries would not have qualified for award for reasons unconnected with the said Order (for example, because they do not meet tender criteria or their price bid is higher or because of the provisions of purchase preference under any other order or rule or any other reason) then there is no need to scrap the tender / start the process de novo.

3. The following examples are given to assist in implementation of the Order.

Example1: Four bids are received in a tender. One of them is from a country which shares a land border with India. The bidder from such country is found to be qualified technically by meeting all prescribed criteria and is also the lowest bidder. In this case, the bidder is qualified for award of the tender, except for the provisions of the Order (Public Procurement No. 1) dated 23rd July. In this case, the tender should be scrapped and fresh tender initiated.

Example 2: The facts are as in Example 1, but the bidder from such country, though technically qualified is not the lowest because there are other technically qualified bidders whose price is lower. Hence the bidder from such country would not be

qualified for award of the tender irrespective of the Order (Public Procurement No. 1) dated 23rd July 2020. In such a case, there is no need to scrap the tender.

Example 3: The facts are as in Example 1, but the bidder from a country which shares a land border with India, though technically qualified, is not eligible for award due to the application of price preference as per other orders/ rules. In such a case, there is no need to scrap the tender.

Example 4: Three bids are received in a tender. One of them is a bidder from a country sharing a land border with India. The bidder from such a country does not meet the technical requirements and hence is not qualified. There is no need to scrap the tender.

(Sanjay Prasad)
Joint Secretary (PPD)
Email ID: js.pfc2.doe@gov.in
Telephone: 011-23093882

To,

(1) Secretaries of All Ministries/ Departments of Government of India for information and necessary action. They are also requested to inform the clarification to all procuring entities.
(2) Secretary, Department of Public Enterprises with a request to immediately circulate this clarification among Public Enterprises.
(3) Chief Secretaries/ Administrators of Union Territories/ National Capital Territory of Delhi

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No. P-45021/2/2017-PP (BE-II)
Government of India
Ministry of Commerce and Industry
Department for Promotion of Industry and Internal Trade
(Public Procurement Section)

Udyog Bhawan, New Delhi
Dated: 16th September, 2020

To

All Central Ministries/Departments/CPSUs/All concerned

ORDER

Subject: Public Procurement (Preference to Make in India), Order 2017– Revision; regarding.

Department for Promotion of Industry and Internal Trade, in partial modification [Paras 2, 3, 5, 10 & 13] of Order No.P-45021/2/2017-B.E.-II dated 15.6.2017 as amended by Order No.P-45021/2/2017-B.E.-II dated 28.05.2018, Order No.P-45021/2/2017-B.E.-II dated 29.05.2019 and Order No.P-45021/2/2017-B.E.-II dated 04.06.2020, hereby issues the revised 'Public Procurement (Preference to Make in India), Order 2017" dated 16.09.2020 effective with immediate effect.

Whereas it is the policy of the Government of India to encourage 'Make in India' and promote manufacturing and production of goods and services in India with a view to enhancing income and employment, and

Whereas procurement by the Government is substantial in amount and can contribute towards this policy objective, and

Whereas local content can be increased through partnerships, cooperation with local companies, establishing production units in India or Joint Ventures (JV) with Indian suppliers, increasing the participation of local employees in services and training them,

Now therefore the following Order is issued:

1. This Order is issued pursuant to Rule 153 (iii) of the General Financial Rules 2017.

2. **Definitions**: For the purposes of this Order:

   'Local content' means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent.

   'Class-I local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-I local supplier' under this Order.

.....Contd. p/2

'Class-II local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, meets the minimum local content as prescribed for 'Class-II local supplier' but less than that prescribed for 'Class-I local supplier' under this Order.

'Non - Local supplier' means a supplier or service provider, whose goods, services or works offered for procurement, has local content less than that prescribed for 'Class-II local supplier' under this Order.

'L1' means the lowest tender or lowest bid or the lowest quotation received in a tender, bidding process or other procurement solicitation as adjudged in the evaluation process as per the tender or other procurement solicitation.

'Margin of purchase preference' means the maximum extent to which the price quoted by a "Class-I local supplier" may be above the L1 for the purpose of purchase preference.

'Nodal Ministry' means the Ministry or Department identified pursuant to this order in respect of a particular item of goods or services or works.

'Procuring entity' means a Ministry or department or attached or subordinate office of, or autonomous body controlled by, the Government of India and includes Government companies as defined in the Companies Act.

'Works' means all works as per Rule 130 of GFR- 2017, and will also include *'turnkey works'*.

3. Eligibility of 'Class-I local supplier'/ 'Class-II local supplier'/ 'Non-local suppliers' for different types of procurement

(a) In procurement of all goods, services or works in respect of which the Nodal Ministry / Department has communicated that there is sufficient local capacity and local competition, only 'Class-I local supplier', as defined under the Order, shall be eligible to bid irrespective of purchase value.

(b) Only 'Class-I local supplier' and 'Class-II local supplier', as defined under the Order, shall be eligible to bid in procurements undertaken by procuring entities, except when Global tender enquiry has been issued. In global tender enquiries, 'Non-local suppliers' shall also be eligible to bid along with 'Class-I local suppliers' and 'Class-II local suppliers'. In procurement of all goods, services or works, not covered by sub-para 3(a) above, and with estimated value of purchases less than Rs. 200 Crore, in accordance with Rule 161(iv) of GFR, 2017, Global tender enquiry shall not be issued except with the approval of competent authority as designated by Department of Expenditure.

(c) For the purpose of this Order, works includes Engineering, Procurement and Construction (EPC) contracts and services include System Integrator (SI) contracts.

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3A. Purchase Preference

(a) Subject to the provisions of this Order and to any specific instructions issued by the Nodal Ministry or in pursuance of this Order, purchase preference shall be given to 'Class-I local supplier' in procurements undertaken by procuring entities in the manner specified here under.

(b) In the procurements of goods or works, which are covered by para 3(b) above and which are divisible in nature, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract for full quantity will be awarded to L1.

ii. If L1 bid is not a 'Class-I local supplier', 50% of the order quantity shall be awarded to L1. Thereafter, the lowest bidder among the 'Class-I local supplier' will be invited to match the L1 price for the remaining 50% quantity subject to the Class-I local supplier's quoted price falling within the margin of purchase preference, and contract for that quantity shall be awarded to such 'Class-I local supplier' subject to matching the L1 price. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price or accepts less than the offered quantity, the next higher 'Class-I local supplier' within the margin of purchase preference shall be invited to match the L1 price for remaining quantity and so on, and contract shall be awarded accordingly. In case some quantity is still left uncovered on Class-I local suppliers, then such balance quantity may also be ordered on the L1 bidder.

(c) In the procurements of goods or works, which are covered by para 3(b) above and which are not divisible in nature, and in procurement of services where the bid is evaluated on price alone, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

i. Among all qualified bids, the lowest bid will be termed as L1. If L1 is 'Class-I local supplier', the contract will be awarded to L1.

ii. If L1 is not 'Class-I local supplier', the lowest bidder among the 'Class-I local supplier', will be invited to match the L1 price subject to Class-I local supplier's quoted price falling within the margin of purchase preference, and the contract shall be awarded to such 'Class-I local supplier' subject to matching the L1 price.

iii. In case such lowest eligible 'Class-I local supplier' fails to match the L1 price, the 'Class-I local supplier' with the next higher bid within the margin of purchase preference shall be invited to match the L1 price and so on and contract shall be awarded accordingly. In case none of the 'Class-I local supplier' within the margin of purchase preference matches the L1 price, the contract may be awarded to the L1 bidder.

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(d) "Class-II local supplier" will not get purchase preference in any procurement, undertaken by procuring entities.

3B. Applicability in tenders where contract is to be awarded to multiple bidders - In tenders where contract is awarded to multiple bidders subject to matching of L1 rates or otherwise, the 'Class-I local supplier' shall get purchase preference over 'Class-II local supplier' as well as 'Non-local supplier', as per following procedure:

a) In case there is sufficient local capacity and competition for the item to be procured, as notified by the nodal Ministry, only Class I local suppliers shall be eligible to bid. As such, the multiple suppliers, who would be awarded the contract, should be all and only 'Class I Local suppliers'.

b) In other cases, 'Class II local suppliers' and 'Non local suppliers' may also participate in the bidding process along with 'Class I Local suppliers' as per provisions of this Order.

c) If 'Class I Local suppliers' qualify for award of contract for at least 50% of the tendered quantity in any tender, the contract may be awarded to all the qualified bidders as per award criteria stipulated in the bid documents. However, in case 'Class I Local suppliers' do not qualify for award of contract for at least 50% of the tendered quantity, purchase preference should be given to the 'Class I local supplier' over 'Class II local suppliers'/ 'Non local suppliers' provided that their quoted rate falls within 20% margin of purchase preference of the highest quoted bidder considered for award of contract so as to ensure that the 'Class I Local suppliers' taken in totality are considered for award of contract for at least 50% of the tendered quantity.

d) First purchase preference has to be given to the lowest quoting 'Class-I local supplier', whose quoted rates fall within 20% margin of purchase preference, subject to its meeting the prescribed criteria for award of contract as also the constraint of maximum quantity that can be sourced from any single supplier. If the lowest quoting 'Class-I local supplier', does not qualify for purchase preference because of aforesaid constraints or does not accept the offered quantity, an opportunity may be given to next higher 'Class-I local supplier', falling within 20% margin of purchase preference, and so on.

e) To avoid any ambiguity during bid evaluation process, the procuring entities may stipulate its own tender specific criteria for award of contract amongst different bidders including the procedure for purchase preference to 'Class-I local supplier' within the broad policy guidelines stipulated in sub-paras above.

4. **Exemption of small purchases**: Notwithstanding anything contained in paragraph 3, procurements where the estimated value to be procured is less than Rs. 5 lakhs shall be exempt from this Order. However, it shall be ensured by procuring entities that procurement is not split for the purpose of avoiding the provisions of this Order.

5. **Minimum local content**: The 'local content' requirement to categorize a supplier as 'Class-I local supplier' is minimum 50%. For 'Class-II local supplier', the 'local content' requirement is minimum 20%. Nodal Ministry/ Department may prescribe only a higher

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percentage of minimum local content requirement to categorize a supplier as 'Class-I local supplier'/ 'Class-II local supplier'. For the items, for which Nodal Ministry/ Department has not prescribed higher minimum local content notification under the Order, it shall be 50% and 20% for 'Class-I local supplier'/ 'Class-II local supplier' respectively.

6. **Margin of Purchase Preference**: The margin of purchase preference shall be 20%.

7. **Requirement for specification in advance**: The minimum local content, the margin of purchase preference and the procedure for preference to Make in India shall be specified in the notice inviting tenders or other form of procurement solicitation and shall not be varied during a particular procurement transaction.

8. **Government E-marketplace**: In respect of procurement through the Government E-marketplace (GeM) shall, as far as possible, specifically mark the items which meet the minimum local content while registering the item for display, and shall, wherever feasible, make provision for automated comparison with purchase preference and without purchase preference and for obtaining consent of the local supplier in those cases where purchase preference is to be exercised.

9. **Verification of local content**:

   a. The 'Class-I local supplier'/ 'Class-II local supplier' at the time of tender, bidding or solicitation shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for 'Class-I local supplier'/ 'Class-II local supplier', as the case may be. They shall also give details of the location(s) at which the local value addition is made.

   b. In cases of procurement for a value in excess of Rs. 10 crores, the 'Class-I local supplier'/ 'Class-II local supplier' shall be required to provide a certificate from the statutory auditor or cost auditor of the company (in the case of companies) or from a practicing cost accountant or practicing chartered accountant (in respect of suppliers other than companies) giving the percentage of local content.

   c. Decisions on complaints relating to implementation of this Order shall be taken by the competent authority which is empowered to look into procurement-related complaints relating to the procuring entity.

   d. Nodal Ministries may constitute committees with internal and external experts for independent verification of self-declarations and auditor's/ accountant's certificates on random basis and in the case of complaints.

   e. Nodal Ministries and procuring entities may prescribe fees for such complaints.

   f. False declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.

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g. A supplier who has been debarred by any procuring entity for violation of this Order shall not be eligible for preference under this Order for procurement by any other procuring entity for the duration of the debarment. The debarment for such other procuring entities shall take effect prospectively from the date on which it comes to the notice of other procurement entities, in the manner prescribed under paragraph 9h below.

h. The Department of Expenditure shall issue suitable instructions for the effective and smooth operation of this process, so that:

   i. The fact and duration of debarment for violation of this Order by any procuring entity are promptly brought to the notice of the Member-Convenor of the Standing Committee and the Department of Expenditure through the concerned Ministry /Department or in some other manner;

   ii. on a periodical basis such cases are consolidated and a centralized list or decentralized lists of such suppliers with the period of debarment is maintained and displayed on website(s);

   iii. in respect of procuring entities other than the one which has carried out the debarment, the debarment takes effect prospectively from the date of uploading on the website(s) in the such a manner that ongoing procurements are not disrupted.

10. **Specifications in Tenders and other procurement solicitations**:

a. Every procuring entity shall ensure that the eligibility conditions in respect of previous experience fixed in any tender or solicitation do not require proof of supply in other countries or proof of exports.

b. Procuring entities shall endeavour to see that eligibility conditions, including on matters like turnover, production capability and financial strength do not result in unreasonable exclusion of 'Class-I local supplier'/ 'Class-II local supplier' who would otherwise be eligible, beyond what is essential for ensuring quality or creditworthiness of the supplier.

c. Procuring entities shall, within 2 months of the issue of this Order review all existing eligibility norms and conditions with reference to sub-paragraphs 'a' and 'b' above.

d. Reciprocity Clause

   i. When a Nodal Ministry/Department identifies that Indian suppliers of an item are not allowed to participate and/ or compete in procurement by any foreign government, due to restrictive tender conditions which have direct or indirect effect of barring Indian companies such as registration in the procuring country, execution of projects of specific value in the procuring country etc., it shall provide such details to all its procuring entities including CMDs/CEOs of PSEs/PSUs, State Governments and other procurement agencies under their administrative control and GeM for appropriate reciprocal action.

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ii. Entities of countries which have been identified by the nodal Ministry/Department as not allowing Indian companies to participate in their Government procurement for any item related to that nodal Ministry shall not be allowed to participate in Government procurement in India for all items related to that nodal Ministry/ Department, except for the list of items published by the Ministry/ Department permitting their participation.

iii. The stipulation in (ii) above shall be part of all tenders invited by the Central Government procuring entities stated in (i) above. All purchases on GeM shall also necessarily have the above provisions for items identified by nodal Ministry/ Department.

iv. State Governments should be encouraged to incorporate similar provisions in their respective tenders.

v. The term 'entity' of a country shall have the same meaning as under the FDI Policy of DPIIT as amended from time to time.

e. Specifying foreign certifications/ unreasonable technical specifications/ brands/ models in the bid document is restrictive and discriminatory practice against local suppliers. If foreign certification is required to be stipulated because of non-availability of Indian Standards and/or for any other reason, the same shall be done only after written approval of Secretary of the Department concerned or any other Authority having been designated such power by the Secretary of the Department concerned.

f. "All administrative Ministries/Departments whose procurement exceeds *Rs.* 1000 Crore per annum shall notify/ update their procurement projections every year, including those of the PSEs/PSUs, for the next 5 years on their respective website."

10A. Action for non-compliance of the Provisions of the Order: In case restrictive or discriminatory conditions against domestic suppliers are included in bid documents, an inquiry shall be conducted by the Administrative Department undertaking the procurement (including procurement by any entity under its administrative control) to fix responsibility for the same. Thereafter, appropriate action, administrative or otherwise, shall be taken against erring officials of procurement entities under relevant provisions. Intimation on all such actions shall be sent to the Standing Committee.

11. **Assessment of supply base by Nodal Ministries**: The Nodal Ministry shall keep in view the domestic manufacturing / supply base and assess the available capacity and the extent of local competition while identifying items and prescribing the higher minimum local content or the manner of its calculation, with a view to avoiding cost increase from the operation of this Order.

12. **Increase in minimum local content**: The Nodal Ministry may annually review the local content requirements with a view to increasing them, subject to availability of sufficient local competition with adequate quality.

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13. **Manufacture under license/ technology collaboration agreements with phased indigenization**: While notifying the minimum local content, Nodal Ministries may make special provisions for exempting suppliers from meeting the stipulated local content if the product is being manufactured in India under a license from a foreign manufacturer who holds intellectual property rights and where there is a technology collaboration agreement / transfer of technology agreement for indigenous manufacture of a product developed abroad with clear phasing of increase in local content.

13A. In procurement of all goods, services or works in respect of which there is substantial quantity of public procurement and for which the nodal ministry has not notified that there is sufficient local capacity and local competition, the concerned nodal ministry shall notify an upper threshold value of procurement beyond which foreign companies shall enter into a joint venture with an Indian company to participate in the tender. Procuring entities, while procuring such items beyond the notified threshold value, shall prescribe in their respective tenders that foreign companies may enter into a joint venture with an Indian company to participate in the tender. The procuring Ministries/Departments shall also make special provisions for exempting such joint ventures from meeting the stipulated minimum local content requirement, which shall be increased in a phased manner.

14. **Powers to grant exemption and to reduce minimum local content**: The administrative Department undertaking the procurement (including procurement by any entity under its administrative control), with the approval of their Minister-in-charge, may by written order, for reasons to be recorded in writing,

    a. reduce the minimum local content below the prescribed level; or
    b. reduce the margin of purchase preference below 20%; or
    c. exempt any particular item or supplying entities from the operation of this Order or any part of the Order.

    A copy of every such order shall be provided to the Standing Committee and concerned Nodal Ministry / Department. The Nodal Ministry / Department concerned will continue to have the power to vary its notification on Minimum Local Content.

15. **Directions to Government companies**: In respect of Government companies and other procuring entities not governed by the General Financial Rules, the administrative Ministry or Department shall issue policy directions requiring compliance with this Order.

16. **Standing Committee**: A standing committee is hereby constituted with the following membership:

    Secretary, Department for Promotion of Industry and Internal Trade—Chairman
    Secretary, Commerce—Member
    Secretary, Ministry of Electronics and Information Technology—Member
    Joint Secretary (Public Procurement), Department of Expenditure—Member
    Joint Secretary (DPIIT)—Member-Convenor

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The Secretary of the Department concerned with a particular item shall be a member in respect of issues relating to such item. The Chairman of the Committee may co-opt technical experts as relevant to any issue or class of issues under its consideration.

17. **Functions of the Standing Committee**: The Standing Committee shall meet as often as necessary, but not less than once in six months. The Committee

a. shall oversee the implementation of this order and issues arising therefrom, and make recommendations to Nodal Ministries and procuring entities.
b. shall annually assess and periodically monitor compliance with this Order
c. shall identify Nodal Ministries and the allocation of items among them for issue of notifications on minimum local content
d. may require furnishing of details or returns regarding compliance with this Order and related matters
e. may, during the annual review or otherwise, assess issues, if any, where it is felt that the manner of implementation of the order results in any restrictive practices, cartelization or increase in public expenditure and suggest remedial measures
f. may examine cases covered by paragraph 13 above relating to manufacture under license/ technology transfer agreements with a view to satisfying itself that adequate mechanisms exist for enforcement of such agreements and for attaining the underlying objective of progressive indigenization
g. may consider any other issue relating to this Order which may arise.

18. **Removal of difficulties**: Ministries /Departments and the Boards of Directors of Government companies may issue such clarifications and instructions as may be necessary for the removal of any difficulties arising in the implementation of this Order.

19. **Ministries having existing policies**: Where any Ministry or Department has its own policy for preference to local content approved by the Cabinet after 1st January 2015, such policies will prevail over the provisions of this Order. All other existing orders on preference to local content shall be reviewed by the Nodal Ministries and revised as needed to conform to this Order, within two months of the issue of this Order.

20. **Transitional provision**: This Order shall not apply to any tender or procurement for which notice inviting tender or other form of procurement solicitation has been issued before the issue of this Order.

(Rajesh Gupta)
Director
Tel: 23063211
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No.F.1/4/2021-PPD
Government of India
Ministry of Finance
Department of Expenditure
Public Procurement Division
*****

264-C, North Block, New Delhi.
18.05.2023.

OFFICE MEMORANDUM

Subject: Concurrent application of Public Procurement Policy for Micro and Small Enterprises Order, 2012 and Public Procurement (Preference to Make in India) Order, 2017.

The undersigned is directed to refer two Preferential Procurement Orders mandated for the Public Procurement in India, namely:

i. Public Procurement Policy for Micro and Small Enterprises (MSEs) Order dated 23.03.2012 (PPP-MSE Order) issued by Ministry of Micro, Small and Medium Enterprises (MoMSME) in exercise of the powers conferred in Section 11 of the MSME Development Act, 2006. (Last revised on 09.11.2018)

ii. Public Procurement (Preference to Make in India) Order, 2017 (PPP-MII order), under Rule 153(iii) of the General Financial Rules (GFRs) 2017, approved by the Cabinet. Implementation of this PPP-MII order is monitored by Department for Promotion of Industry and Internal Trade (DPIIT). (Last revised on 16.09.2020.)

2. It has been brought to the notice of this Department that concurrent application of these two orders are creating confusion to the procuring entities and different procuring entities interpret them differently. In order to bring predictability both to the procuring entities as well as bidders, following guidelines are being issued.

Guidelines

3. The Class-I local suppliers, under PPP-MII Order, participating in any government tender, may or may not be MSEs, as defined under the MSME Act. Similarly, MSEs participating in any government tender, may or may not be Class-I local suppliers. Suppliers may be categorised in following four broad categories for consideration or applicability of purchase preference:

Category	**Terminology**
Supplier is both MSE & Class-I local supplier.	"MSE Class-I local supplier"
Supplier is MSE but not Class-I local supplier.	"MSE but non-Class-I local supplier"
Supplier is not MSE but is Class-I local supplier.	"Non-MSE but Class-I local supplier"
Supplier is neither MSE nor Class-I local.	"Non-MSE non-Class-I local supplier"

4. The applicability of PPP-MSE Order and PPP-MII Order in various scenarios, involving simultaneous purchase preference to MSEs and Class-I local suppliers under PPP-MSE Order and PPP-MII Order respectively, shall be as under:

a) *Items covered under Para 3(a) of PPP- MII Order, 2017 for which Nodal Ministry has notified sufficient local capacity and competition:* For these items, only Class-I local suppliers are eligible to bid irrespective of purchase value. Hence, Class-II local suppliers or Non-local suppliers, including MSEs which are Class-II local suppliers/ Non-local suppliers, are not eligible to bid. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - 100% of the tendered quantity is to be awarded to L-1.

(ii) L-1 is "Non-MSE but Class-I local supplier" - Purchase preference is given to MSEs as per PPP-MSE Order. Balance quantity is to be awarded to the L-1 bidder.

b) *Items reserved exclusively for procurement from MSEs as per PPP-MSE Order:* These items are reserved exclusively for purchase from MSEs. Hence, non-MSEs are not eligible to bid for these items. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - 100% of the tendered quantity is to be awarded to L-1.

(ii) L-1 is "MSE non-Class–I local supplier" - Purchase preference is to be given to Class-I local supplier as per PPP-MII Order. Balance quantity, is to be awarded to L-1 bidder.

c) *If items are neither notified for sufficient local capacity nor reserved for MSEs, then the process will be as follows:*

c (a) Items covered under Para 3A(b) of PPP-MII Order are divisible items and both MSEs as well as Class-I local suppliers are eligible for purchase preference. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - 100% of the tendered quantity is to be awarded to L-1.

(ii) L-1 is "Non-MSE but Class-I local supplier" - Purchase preference is to be given to MSEs, if eligible, as per PPP-MSE Order. Balance quantity is to be awarded to L-1 bidder.

(iii) L-1 is "MSE but non-Class-I local supplier" - Purchase preference is to be given to Class-I local suppliers, if eligible, as per PPP-MII Order. Balance quantity is to be awarded to L-1 bidder.

(iv) L-1 is "Non-MSE non-Class-I local supplier" - Purchase preference is to be given to MSEs as per PPP-MSE Order. Thereafter, purchase preference is to be given to Class-I local suppliers for "50% of the tendered quantity minus quantity allotted to MSEs

above" as per PPP- MII Order. For the balance quantity, contract is to be awarded to L-1 bidder. *(Kindly refer to the illustrative example in the annexure).*

c (b) Items covered under Para 3A(c) of PPP-MII Order, 2017 are non-divisible items and both MSEs as well as Class-I local suppliers are eligible for purchase preference. Possible scenarios can be as under:

(i) L-1 is "MSE Class-I local supplier" - Contract is awarded to L-1.

(ii) L-1 is not "MSE Class-I local supplier" but the "MSE Class-I local supplier" falls within 15% margin of purchase preference - Purchase preference is to be given to lowest quoting "MSE Class-I local supplier". If lowest quoting "MSE Class-I local supplier" does not accept the L-1 rates, the next higher "MSE Class-I local supplier" falling within 15% margin of purchase preference is to be given purchase preference and so on.

(iii) If conditions mentioned in sub paras (i) and (ii) above are not met i.e. L-1 is neither "MSE Class-I local supplier" nor "MSE Class-I local supplier" is eligible to take benefit of purchase preference, the contract is to be awarded/ purchase preference to be given in different possible scenarios as under:

A. L1 is "MSE but non-Class-I local supplier" or "Non-MSE but Class-I local supplier" – Contract is be awarded to L1.

B. L1 is "Non-MSE non-Class-I local supplier" - First purchase preference to be given to MSE as per PPP-MSE Order. If MSE not eligible/ does not accept - purchase preference to be given to Class- I Local supplier as per PPP-MII Order. If Class-I Local supplier also not eligible/ does not accept – contract to be awarded to L-1.

d) *Items reserved for both MSEs and Class-I local suppliers*: These items are reserved exclusively for purchase from MSEs as well as Class-I local suppliers. Hence, only "MSE Class-I local supplier" are eligible to bid for these items. Non-MSEs/Class-II local suppliers/ Non-local suppliers cannot bid for these items. Hence the question of purchase preference does not arise.

e) Non-local suppliers, including MSEs falling in the category of Non-local suppliers, shall be eligible to bid only against Global Tender Enquiry.

18/5/2023

(Kanwalpreet)
Director
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To

1. Secretaries of all Central Government Ministries/ Departments.
2. Secretary Department of Public Enterprises with a request for issuing suitable instructions to all Central Public Sector Enterprises in this regard.

Annexure

Example explaining applicability in scenario explained in para 4 c (a)(iv)

(Scenario: Divisible items, both MSEs as well as Class-I local suppliers eligible for purchase preference and L-1 is "Non-MSE non-Class-I local supplier")

Item – Desktop computer

Qty – 50 Nos.

Details of bids received

Sr. No.	Name of bidder	Rates quoted	Price Ranking	Status of bidder
1.	A	100	L1	"Non-MSE non- Class-I local supplier"
2.	B	110	L2	"Non-MSE but Class-I local supplier"
3.	C	112	L3	"MSE but non- Class-I local supplier"
4.	D	115	L4	"Non-MSE but Class-I local supplier"
5.	E	118	L5	"MSE but non- Class-I local supplier"
6.	F	120	L6	"MSE Class-I local supplier"

1. In this case, first purchase preference is to be given to MSEs as per PPP-MSE Order for 25% of tendered quantity of 50 Nos. i.e. 12.5 Nos. (rounded off to the next whole number say 13 Nos). Accordingly, invite L3 (bidder C), whose quoted rates falls within 15% margin of purchase preference to match L1 price i.e. Rs. 100/- for quantity of 13 Nos. Bidder "E" and "F", although MSEs, will not get purchase preference since their quoted rates don't fall within 15% margin of purchase preference. Bidder C will be considered for order of 13 Nos. on confirmation of reduction of price.

2. For 50% of balance quantity of 37 number (tendered quantity of 50 – 13 awarded to bidder C; assuming bidder C has confirmed to accept L1 rates), purchase preference will be given to lowest Class-I local supplier as per PPP-MII Order. Accordingly, bidder B will be invited to match L-1 price for 50% of 37 Nos i.e. 18.5 (say 19 Nos of computers). If bidder "B" does not accept the L1 price i.e. price of Rs. 100/- per unit, next higher Class-I local supplier falling within 20% margin of purchase preference, i.e. bidder "D", may be invited to match L-1 price for 19 Nos. of computers and so on.

3. For remaining quantity i.e. 18 Nos (50-13-19), the contract will be awarded to lowest quoting bidder i.e. Bidder "A", who is L-1 in the example.

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