

Cast Steels

| Type                                      | ASTM Specification |       | Chemical Composition % |             |       |       |          |               |               |             |                 | Mechanical Characteristics            |                                  |              |                    |
|---|--------------------|-------|------------------------|-------------|-------|-------|----------|---------------|---------------|-------------|-----------------|---------------------------------------|----------------------------------|--------------|--------------------|
|   | Design             | Grade | C Max                  | Mn          | P Max | S Max | Si       | Ni            | Cr            | Mo          | Other Elements  | Tensile Strength R Kg/mm <sup>2</sup> | Yield Point S Kg/mm <sup>2</sup> | Elongation % | Reduction of area% |
| Carbon Steel                              | A216               | WCB   | 0.30                   | 1.00 Max    | 0.04  | 0.045 | 0.60 Max | -             | -             | -           | 1.00 Max        | 49.2                                  | 25.3                             | 22           | 35                 |
|   |                    | WCC   | 0.25                   | 1.20 Max    | 0.04  | 0.045 | 0.60 Max | -             | -             | -           | 1.00 Max        | 49.2                                  | 28.1                             | 22           | 35                 |
| Alloy Steels for High Temperature Service | A217               | WC1   | 0.25                   | 0.50 - 0.80 | 0.04  | 0.045 | 0.60 Max | -             | -             | 0.45 - 0.65 | 1.00 Max        | 45.7                                  | 25.3                             | 24           | 35                 |
|   |                    | WC6   | 0.20                   | 0.50 - 0.80 | 0.04  | 0.045 | 0.60 Max | -             | 1.00 - 1.50   | 0.45 - 0.65 | 1.00 Max        | 49.2                                  | 28.1                             | 20           | 35                 |
|   |                    | WC9   | 0.18                   | 0.40 - 0.70 | 0.04  | 0.045 | 0.60 Max | -             | 2.00 - 2.75   | 0.90 - 1.20 | 1.00 Max        | 49.2                                  | 28.1                             | 20           | 35                 |
|   |                    | C5    | 0.20                   | 0.40 - 0.70 | 0.04  | 0.045 | 0.75 Max | -             | 4.00 - 6.50   | 0.45 - 0.65 | 1.00 Max        | 63.3                                  | 42.2                             | 18           | 35                 |
|   |                    | C12   | 0.20                   | 0.35 - 0.65 | 0.04  | 0.045 | 1.00 Max | -             | 8.00 - 10.00  | 0.90 - 1.20 | 1.00 Max        | 63.3                                  | 42.2                             | 18           | 35                 |
| Stainless Steels                          | A351               | CF3   | 0.03                   | 1.50 Max    | 0.04  | 0.040 | 2.00 Max | 8.00 - 12.00  | 17.00 - 21.00 | -           | -               | 49.2                                  | 21.1                             | 35           | -                  |
|   |                    | CF8   | 0.08                   | 1.50 Max    | 0.04  | 0.040 | 2.00 Max | 8.00 - 11.00  | 18.00 - 21.00 | -           | -               | 49.2                                  | 21.1                             | 35           | -                  |
|   |                    | CF3M  | 0.03                   | 1.50 Max    | 0.04  | 0.040 | 1.50 Max | 9.00 - 13.00  | 17.00 - 21.00 | 2.00 - 3.00 | -               | 49.2                                  | 21.1                             | 30           | -                  |
|   |                    | CF8M  | 0.08                   | 1.50 Max    | 0.04  | 0.040 | 1.50 Max | 9.00 - 12.00  | 18.00 - 21.00 | 2.00 - 3.00 | -               | 49.2                                  | 21.1                             | 30           | -                  |
|   |                    | CF8C  | 0.08                   | 1.50 Max    | 0.04  | 0.040 | 2.00 Max | 9.00 - 12.00  | 18.00 - 21.00 | -           | Cb < 8xC < 1.00 | 49.2                                  | 21.1                             | 30           | -                  |
|   |                    | CN7M  | 0.07                   | 1.50 Max    | 0.04  | 0.040 | 1.50 Max | 27.50 - 30.50 | 19.00 - 22.00 | 2.00 - 3.00 | Copper          | 43.6                                  | 17.6                             | 35           | -                  |
| Carbon Steels for Low Temperature Service | A352               | LCB   | 0.30                   | 1.00 Max    | 0.04  | 0.045 | 0.60 Max | -             | -             | -           | -               | 45.7                                  | 24.6                             | 24           | 35                 |
|   |                    | LCC   | 0.25                   | 1.20 Max    | 0.04  | 0.045 | 0.60 Max | -             | -             | -           | -               | 49.2                                  | 28.1                             | 22           | 35                 |
|   |                    | LC1   | 0.25                   | 0.50 - 0.80 | 0.04  | 0.045 | 0.60 Max | -             | -             | 0.45 - 0.65 | -               | 45.7                                  | 24.6                             | 24           | 35                 |
|   |                    | LC2   | 0.25                   | 0.50 - 0.80 | 0.04  | 0.045 | 0.60 Max | 2.00 - 3.00   | -             | -           | -               | 49.2                                  | 28.1                             | 24           | 35                 |
|   |                    | LC3   | 0.15                   | 0.50 - 0.80 | 0.04  | 0.045 | 0.60 Max | 3.00 - 4.00   | -             | -           | -               | 49.2                                  | 28.1                             | 24           | 35                 |
|   |                    | LC4   | 0.15                   | 0.50 - 0.80 | 0.04  | 0.045 | 0.60 Max | 4.00 - 5.00   | -             | -           | -               | 49.2                                  | 28.1                             | 24           | 35                 |

Exotic Materials

| Type        | ASTM Specification |        | Chemical Composition % |             |        |        |             |             |             |             |  | Mechanical Characteristics            |                                  |              |
|-------------|--------------------|--------|------------------------|-------------|--------|--------|-------------|-------------|-------------|-------------|--|---------------------------------------|----------------------------------|--------------|
|             | Design             | Grade  | C Max                  | Fe          | Si Max | Mn Max | Ni          | Cr          | Cu          | Mo          | Other Elements   | Tensile Strength R Kg/mm <sup>2</sup> | Yield Point S Kg/mm <sup>2</sup> | Elongation % |
| Alloy 20    | A351 or A296       | CN7M   | 0.07                   | -           | 1.50   | 1.50   | 27.5 - 30.5 | 19.0 - 22.0 | 3.0 - 4.0   | 2.0 - 3.0   | P-0.04 Max<br>S-0.04 Max   | 43.6                                  | 17.6                             | 35           |
| Hastelloy-B | A296               | N12M   | 0.12                   | 4.00 - 6.00 | 1.00   | 1.00   | Remainder   | 1.00 Max    | -           | 26.0 - 33.0 | V-0.60;<br>Co- 2.5 Max<br>P-0.04 Max<br>S-0.04 Max                 | 52.8                                  | 32.3                             | 6            |
|             | A294               | N12M1  |                        |             |        |        |             |             |             |             |  |                                       |                                  |              |
| Hastelloy-C | A296               | CW12M1 | 0.12                   | 4.50 - 7.50 | 1.50   | 1.00   | Remainder   | 15.5 - 20.0 | -           | 16.0 - 20.0 | P-0.04 Max<br>S-0.03 Max<br>Tungst. 5.25<br>V-0.40;<br>Co- 2.5 Max | 50.6                                  | 32.3                             | 4            |
|             | A494               | CW12M1 |                        |             |        |        |             |             |             |             |  |                                       |                                  |              |
| Inconel     | A296 or A494       | CY-40  | 0.40                   | 11.0 Max    | 3.00   | 1.50   | Remainder   | 14.0 - 17.0 | -           | -           | P-0.03 Max<br>S-0.03 Max   | 49.2                                  | 19.7                             | 30           |
| Monel       | A296 or A494       | M-35   | 0.35                   | 3.50 Max    | 2.00   | 1.50   | Remainder   | -           | 26.0 - 33.0 | -           | P-0.03 Max<br>S-0.03 Max   | 45.7                                  | 21.1                             | 25           |

Forged Steels

| Type                               | ASTM Specification |       | Chemical Composition % |             |       |       |           |            |             |           |                 | Mechanical Characteristics               |                                     |              |                    |
|------------------------------------|--------------------|-------|------------------------|-------------|-------|-------|-----------|------------|-------------|-----------|-----------------|--|-------------------------------------|--------------|--------------------|
|                                    | Design             | Grade | C                      | Mn          | P Max | S Max | Si        | Ni         | Cr          | Mo        | Other Elements  | Tensile Strength<br>R Kg/mm <sup>2</sup> | Yield Point<br>S Kg/mm <sup>2</sup> | Elongation % | Reduction of area% |
| Carbon Steel                       | A105               | -     | 0.35 Max               | 0.60 - 1.05 | 0.040 | 0.050 | 0.35 Max  | -          | -           | -         | -               | 49.2                                     | 25.3                                | 22           | 30                 |
| Carbon Steels for Low Temperatures | A350               | LF2   | 0.30 Max               | 1.35 Max    | 0.040 | 0.050 | 0.15-0.30 | -          | -           | -         | -               | 49.2                                     | 25.3                                | 22           | 30                 |
| Alloy Steels for High Temperatures | A182               | F6    | 0.12 Max               | 1.00 Max    | 0.040 | 0.040 | 1.00 Max  | 0.50 Max   | 11.50-13.50 | -         | -               | 59.8                                     | 38.7                                | 25           | 60                 |
|                                    |                    | F9    | 0.15 Max               | 0.30-0.60   | 0.030 | 0.030 | 0.50-1.00 | -          | 8.00-10.00  | 0.90-1.10 | -               | 70.3                                     | 49.2                                | 20           | 40                 |
|                                    |                    | F11   | 0.10-0.20              | 0.30-0.80   | 0.040 | 0.040 | 0.50-1.00 | -          | 1.00-1.50   | 0.44-0.65 | -               | 49.2                                     | 28.1                                | 20           | 30                 |
|                                    |                    | F22   | 0.15 Max               | 0.30-0.60   | 0.040 | 0.040 | 0.50 Max  | -          | 2.00-2.50   | 0.87-1.13 | -               | 49.2                                     | 28.1                                | 20           | 30                 |
| Stainless Steels                   | A182               | F304  | 0.08 Max               | 2.00 Max    | 0.040 | 0.030 | 1.00 Max  | 8.0-11.0   | 18.0-20.0   | -         | -               | 52.8                                     | 21.1                                | 45           | 50                 |
|                                    |                    | F316  | 0.08 Max               | 2.00 Max    | 0.040 | 0.030 | 1.00 Max  | 10.0-14.00 | 16.0-18.0   | 2.0-3.0   | -               | 52.8                                     | 21.1                                | 45           | 50                 |
|                                    |                    | F316H | 0.04-0.10              | 2.00 Max    | 0.040 | 0.030 | 1.00 Max  | 10.0-14.0  | 16.0-18.0   | 2.0-3.0   | -               | 45.7                                     | 21.1                                | 45           | 50                 |
|                                    |                    | F321  | 0.08 Max               | 2.50 Max    | 0.035 | 0.030 | 0.85 Max  | 9.0 Min    | 17.0 Min    | -         | Ti 5% C Min     | 52.8                                     | 21.1                                | 45           | 50                 |
|                                    |                    | F321H | 0.04-0.10              | 2.50 Max    | 0.035 | 0.030 | 0.85 Max  | 9.0 Min    | 17.0 Min    | -         | Ti 5% C Min     | 52.8                                     | 21.1                                | 45           | 50                 |
|                                    |                    | F347  | 0.08 Max               | 2.00 Max    | 0.030 | 0.030 | 1.00 Max  | 9.0-13.0   | 17.0-20.0   | -         | Cb+Ta 10% C Min | 52.8                                     | 21.1                                | 45           | 50                 |
|                                    |                    | F347H | 0.04-0.10              | 2.00 Max    | 0.030 | 0.030 | 1.00 Max  | 9.0-13.0   | 19.0-22.0   | -         | Cb+Ta 10% C Min | 52.8                                     | 21.1                                | 45           | 50                 |

Other materials are available on request. Please contact one of our stockists or our technical department for clarification.