TECHNICAL BULLETIN #43
NORTH AMERICAN CRANE RAIL

North American crane rail sections are manufactured to ASTM A759 – 00. Only one company, ArcelorMittal, remains as a producer of these sections manufacturing them at their plant in Steelton, PA. The only CR sections currently available from ArcelorMittal are: 104CR, 135CR, 171CR and 175CR. All are available in three grades, only two of which are described in ASTM A759. The more recent addition of "high carbon" or HC rails has yet to be addressed in the ASTM standard.

Until mid 2007 rails manufactured to ASTM A759-00, including head hardened rails, were available from Europe. This is no longer the case. There are still some European manufacturers rolling a limited number of crane rails that are similar to North American crane rail geometry but the chemical and mechanical properties of the rails meet European, not North American standards.

The ArcelorMittal crane rail grades and their mechanical properties are:

		HEAD		WEB & FLANGE
Rail Grade	**Chemistry***	**Minimum guaranteed mechanical properties**	**Typical range of mechanical properties**	**Typical range of mechanical properties**
Control Cooled	0.67 ≤ C ≤ 0.84% 0.70 ≤ Mn ≤ 1.10% P ≤ 0.040% S ≤ 0.050% 0.10 ≤ Si ≤0.50%	285 BHN	300 - 331 BHN 65 - 90 ksi yield 135 - 160 ksi tensile	300 - 331 BHN 65 - 90 ksi yield 135 - 160 ksi tensile
Head Hardened	0.75 ≤ C ≤ 0.84% 0.70 ≤ Mn ≤ 1.10% P ≤ 0.040% S ≤ 0.050% 0.10 ≤ Si ≤0.50%	321 BHN	335 - 375 BHN 105 - 125 ksi yield 165 - 185 ksi tensile	300 - 331 BHN 65 - 90 ksi yield 135 - 160 ksi tensile
High Carbon	0.84 ≤ C ≤ 0.92% 0.70 ≤ Mn ≤ 1.30% P ≤ 0.040% S ≤ 0.050% 0.10 ≤ Si ≤0.70%	352 BHN	352 - 410 BHN 115 - 135 ksi yield 175 - 195 ksi tensile	300 - 331 BHN 70 – 95 ksi yield 140 – 165 ksi tensile
*C = Carbon; Mn = Manganese; P = Phosphorus; S = Sulphur; Si = Silicon				

It should be noted that of the parameters listed in the table above, only the rail chemistry of control cooled and head hardened rails and the minimum Brinell hardness of a head hardened rail head are defined by ASTM A759-00. All other data listed is specific to the rail products manufactured by ArcelorMittal at their Steelton, PA mill.

GANTREX, INC
275 Curry Hollow Road
Suite 290
Pittsburgh, PA 15236
USA

Tel: 1 412 655 1400
Fax: 1 412 655 3814
E-mail: info@gantrex.com
Website: www.gantrex.com

Gantrex Sales Offices:
Halifax, Houston, Montreal,
Monterrey, Phoenix, Pittsburgh, Seattle,
Toronto

ISO Certification at the Toronto location

In the past, hardened CR rail sections supplied from the Steelton mill were fully hardened. This process involved fully heat treating the rail in a furnace followed by oil quenching. This process is no longer available from the Steelton mill as it could not meet modern air emission control standards and the rails produced were considered by some as too brittle in the web and flange area.

The standard method of hardening rails at the Steelton plant is now head hardening. North American crane rail sections are available from the Steelton mill head hardened in accordance with supplementary requirement S2 of ASTM 759-00. When this option is selected the rail head hardness, as defined by the standard, is to fall within the range of from 321–388BHN. The larger crane rail sections, 171CR and 175CR, are somewhat more difficult to head harden and, all things being equal, a heavier section will have a lower head hardness value than a comparable lighter section when processed in an equivalent manner.

The strength of the head hardened area of the rail is about 105-125ksi yield (165-185ksi tensile) but it must be understood that this only applies to a depth of about 3/4" - 1" of the rail head. The web and flange area of the rail should be considered as equal in strength to control cooled rail.

High Carbon rail (0.84-0.92% carbon) allows for higher head hardness but again, the web and flange areas are not affected by the head hardening process. The web and flange areas will have slightly higher strength than standard control cooled rails because of the higher carbon content.

The industry must be careful to use the appropriate rail strength values when performing evaluations. The designer should assume the lowest value of the typical mechanical properties listed in the table on page 1 when performing engineering calculations.

Charles Bowers
Technical Manager
Gantrex Inc.
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