

Data Sheet: A4.1

Drawing and Forming Steel Grades

Hot rolled formable steel coil

General description

Mittal Steel South Africa normally produces hot rolled drawing and forming steels in accordance with BS 1449: Section 1.2: 1991 or equivalent EN 10111 grades. Similar steels in accordance with other specifications such as DIN 1614 can be produced on enquiry.

Hot rolled drawing and forming steels are intended for applications where cold formability is the primary requirement. Formability is normally assured by careful control of the chemical composition of the steel and the subsequent processing parameters. These steel grades may be welded using any of the standard arc and resistance welding processes without any special precautions.

The following four steel grades produced by Mittal Steel South Africa offer a series of decreasing formability.

Table 1. Degree of formability

EN 10111 Grade	BS 1449 Grade	Description
DD14	KHR1	Extra deep drawing properties for fabricating parts where very severe drawing or forming is involved.
DD13	HR2	Extra deep drawing properties for applications involving severe drawing.
DD12	HR3	Deep drawing quality for general drawing applications.
DD11	HR4	Drawing or forming quality for general forming applications.

The drawing and forming steels must be differentiated from the SUPRAFORM[®] HR and TM ranges which are structural steels with improved formability.

Formability requirements vary widely. It may be advisable to seek the advice of the supplier concerning the most suitable steel for a new application. In certain non-critical applications it would be more economical to use commercial steels as described in the data sheet: General Purpose and Commercial Steels (file reference A2.1)

Chemical composition

Table 2. Chemical composition (ladle analysis, percent) as specified in BS 1449: Part 1: Section 1.2: 1991

Grade	C max	Mn max	P max	S max
KHR1 ¹	0,08	0,45	0,025	0,030
HR2 ²	0,08	0,54	0,030	0,035
HR3 ²	0,10	0,50	0,040	0,040
HR4 ²	0,12	0,60	0,050	0,050

For further information, contact:

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Care has been taken to ensure that the information in this data sheet is accurate. Mittal Steel South Africa Limited does not, however, assume responsibility for any inaccuracies or misinterpretations of this data. We are continuously engaged in product development and revised data sheets will be issued from time to time. Please ensure that you have the most recent issue. Effective date: October 2005

Table 3. Chemical composition (ladle analysis, percent) as specified in EN 10111

Grade	C max	Mn max	P max	S max
DD14 ¹	0,08	0,35	0,025	0,025
DD13 ²	0,08	0,40	0,030	0,030
DD12 ²	0,10	0,45	0,035	0,035
DD11 ²	0,12	0,60	0,045	0,045

Notes:

1. KHR1 and DD14 is always aluminium killed and continuously cast with an aluminium content of 0,02% minimum.
2. HR2, HR3, HR4, DD13, DD12 and DD11 are aluminium killed and continuously cast.

Mechanical properties

The mechanical properties indicated in Table 4 & 5 are the minimum values specified. The material will exhibit the indicated properties in the hot rolled condition before any drawing or forming has taken place. Cold forming of steel results in work hardening that can result in an increase in yield strength and a decrease in elongation.

The tensile properties given in brackets are for guidance only and are not mandatory unless agreed upon at the time of ordering.

Table 4. Mechanical properties as specified in BS 1449: Part 1: Section 1.2: 1991 Table 2

Grade	Minimum yield strength (MPa)	Minimum tensile strength (MPa)	Minimum elongation (%) for a gauge length of ¹		Mandrel diameter for 180° bend test for strip thickness <i>t</i>	
			50 mm	200 mm	<i>t</i> < 3 mm	<i>t</i> ≥ 3 mm
KHR1 ¹	170	290	34	25	0 <i>t</i>	0 <i>t</i>
HR2 ²	170	290	34	25	0 <i>t</i>	0 <i>t</i>
HR3 ²	(170)	(290)	(28)	(21)	0 <i>t</i>	0 <i>t</i>
HR4 ²	(170)	(280)	(25)	(18)	1 <i>t</i>	2 <i>t</i>

Notes:

1. For material thinner than 2,3mm, the percentage elongation is reduced by 1% for each 0,25 mm reduction in thickness.
2. Test and analysis certificates are supplied for KHR1 and HR2. For HR3 and HR4 the tensile properties given in brackets are for guidance only and are not mandatory unless agreed to at the time of ordering.
3. Test certificates will not normally be supplied for these grades.

Table 5. Mechanical properties as specified in EN 10111, Table 2

Grade	Minimum yield strength (MPa)	Maximum tensile strength (MPa)	Minimum elongation (%) for a gauge length of 80 mm	Minimum elongation (%) for a gauge length of $L_0 = 5,55/S_0$	Mandrel diameter for 180° bend test for strip thickness <i>t</i>
			$2 \geq t < 3$ mm	$t \geq 3$ mm	$t \geq 2$ mm
DD14	170 - 290	380	32	36	0 <i>t</i>
DD13	170 - 330	400	29	33	0 <i>t</i>
DD12	170 - 320	420	26	30	0 <i>t</i>
DD11	170 - 340	440	24	28	0 <i>t</i>

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Dimensions

Drawing and forming steels are available in thicknesses ranging from 2,0mm to 10,0mm and widths from 760mm to 1 870mm.

In order to possess good drawing, forming and pressing properties, hot rolled strip must have a homogeneous microstructure that can be achieved only if the strip temperature is accurately controlled during hot rolling. This becomes difficult when the thickness is less than 2,0mm. Therefore, if thinner material is required, cold rolled strip should be used.

For more detail on the dimensions available, refer to the data sheet: Hot Strip Mill Product Dimensions (file reference A1.1).

Dimensional tolerances

For dimensional tolerances, refer to the data sheet: Hot Strip Mill Product Tolerances (file reference A1.2).

Certification

Analysis and test certificates will be supplied subject to the conditions described in Table 3, note 2.

Supply conditions

All material described in this data sheet is supplied in terms of Price Lists 120 and 121 and Mittal Steel South Africa's General Conditions of Sale.

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