

PUBLIC FILE VERSION



EXPORTER VISIT BRIEFING – HYUNDAI STEEL

Review of Measures 465 : Hot Rolled Structural Sections exported from South Korea

THURSDAY 17TH MAY 2018



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CAVEAT: SOURCE DATA

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The exporter's preparation of a summary of its response to Exporter Questionnaire suitable for the public record DOES NOT contain sufficient detail to **allow a reasonable understanding of the substance of the information.**

Therefore, the material presented in this Exporter Visit Briefing has been obtained independently of the Exporter's response (EPR465/004) and nothing within this briefing should be construed to suggest that the Australian industry consents to the sufficiency of detail provided within the exporter's public record version of its response to the Commission's questionnaire.

The Australian industry submits that the Commissioner CANNOT BE reasonably satisfied in accordance with s 269ZJ(5)(a) that all the information redacted by the exporter in the public record version is confidential or would adversely affect the exporter's business or commercial interests.

The Commissioner should indicate in accordance with s 269ZJ(5)(b) that he disagrees with the exporter's claims in order to procure a summary of the information in accordance with the standard required by s269ZJ(2).

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AGENDA

- 1 The Goods : shapes & applications
- 2 The Goods : important properties
- 3 Model matching : criteria
- 4 Model matching : establishing grade
- 5 Hyundai Steel
- 6 Adjustments



THE GOODS

Hot rolled structural steel sections in the following shapes and sizes, whether or not containing alloys:

- ▶ universal beams (I sections), of a height greater than 130mm and less than 650mm;
- ▶ universal columns and universal bearing piles (H sections), of a height greater than 130mm and less than 650mm;
- ▶ channels (U sections and C sections) of a height greater than 130mm and less than 400mm; and
- ▶ equal and unequal angles (L sections), with a combined leg length of greater than 200mm.

Sections and/or shapes in the dimensions described above, that have minimal processing, such as cutting, drilling or painting do not exclude the goods from coverage of the application.

Goods excluded from this application are:

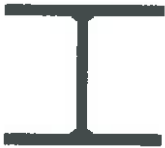
- ▶ hot rolled 'T' shaped sections, sheet pile sections and hot rolled merchant bar shaped sections, such as rounds, squares, flats, hexagons, sleepers and rails; and
- ▶ sections manufactured from welded plate (e.g. welded beams and welded columns)

THE GOODS

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Universal Beams



Universal Columns



Parallel Flange Channels



Universal Bearing Piles

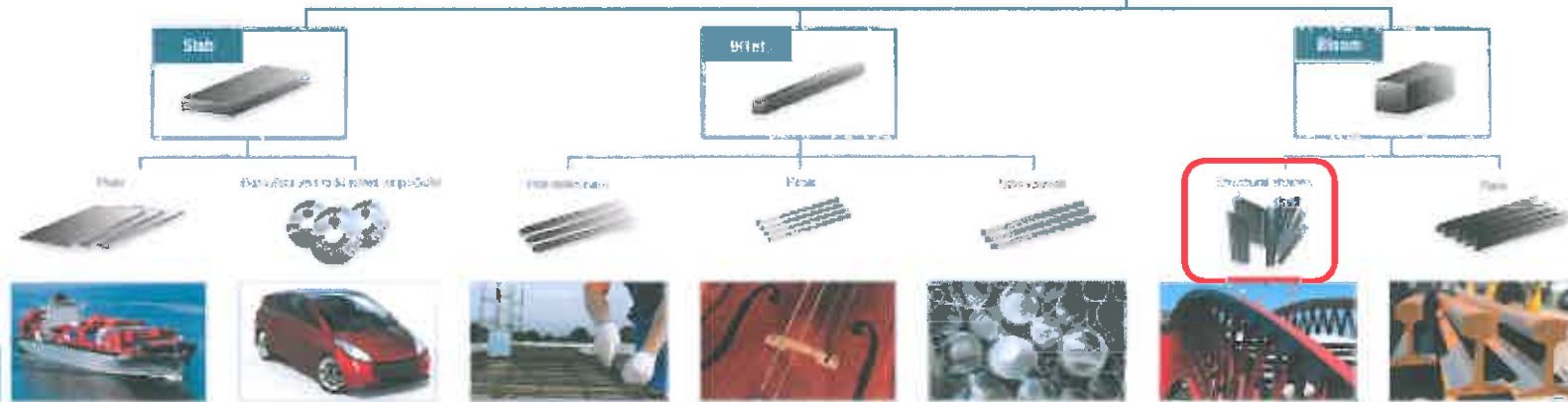
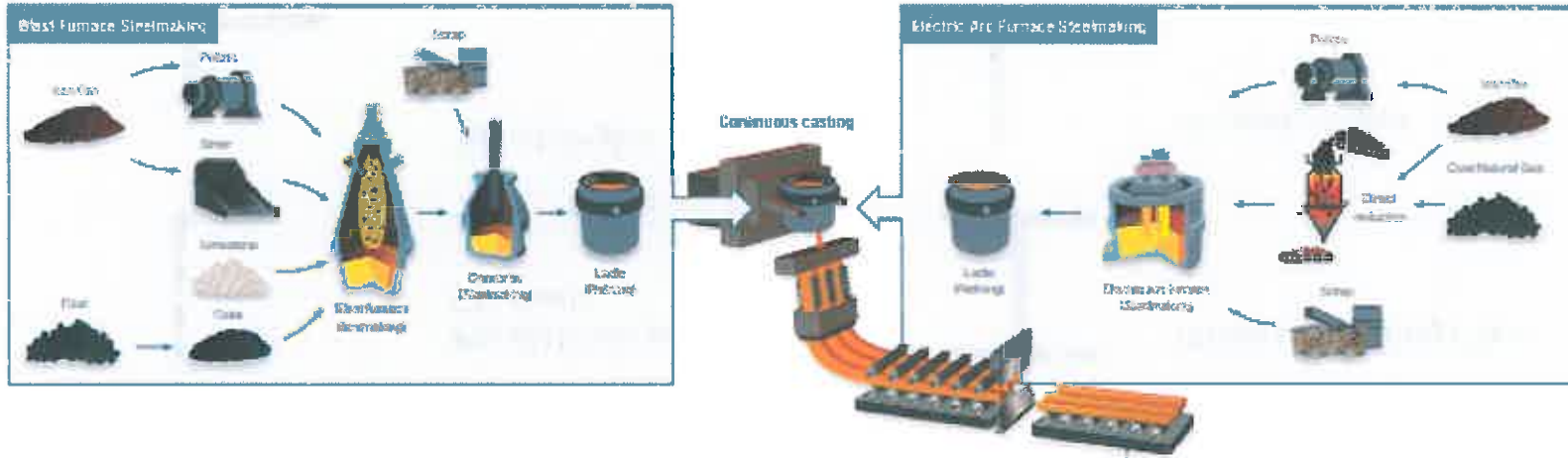


Equal Angles

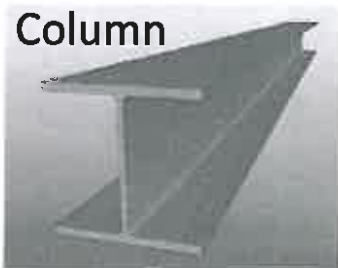


Unequal Angles





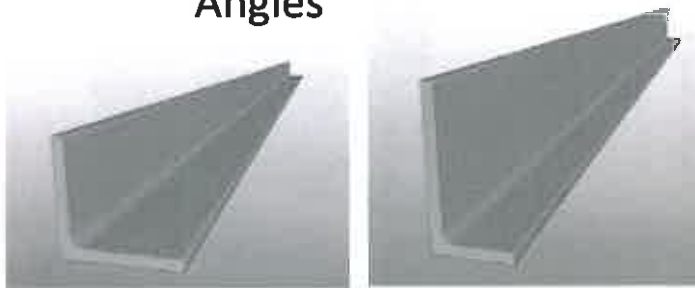
THE GOODS - APPLICATIONS



- ▶ Structural steel is generally used to form the 'skeleton' frame of a building or structure, typically with columns and beams welded, riveted or bolted together.

THE GOODS - APPLICATIONS

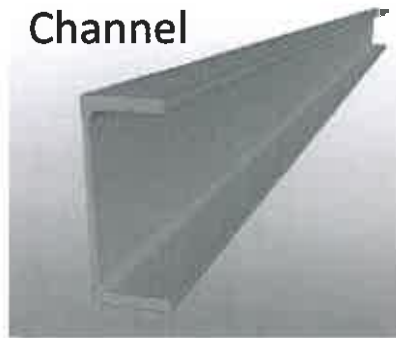
Angles



- ▶ Equal angles (legs of same length) most often used for balconies, stairs, concrete supports & platforms.
- ▶ Unequal angles (longer vertical leg) often used as lintels due to greater loading capabilities.



Channel



- ▶ Channels/PFC's (parallel flange channels)/C-sections most commonly used for columns, lintels, or as a beam supporting floor joists.

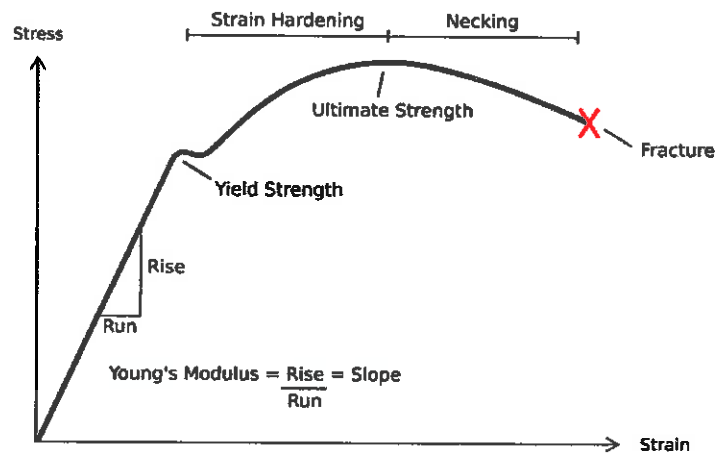
THE GOODS

IMPORTANT PROPERTIES : YIELD STRENGTH

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Steel **SteelConstruction.info**
The free encyclopedia for UK steel construction information



“**Product standards** define the limits for composition, quality and performance and these limits are used or presumed by structural designers.”

“**Yield strength** is the most common property that the designer will need as it is the basis used for most of the rules given in **design codes**. In European Standards for structural carbon steels, the primary designation relates to the yield strength, e.g. S355 steel is a structural steel with a specified minimum yield strength of 355 N/mm².

The **product standards** also specify the permitted range of values for the ultimate tensile strength (UTS). The minimum UTS is relevant to some aspects of design.”

https://www.steelconstruction.info/Steel_material_properties

THE GOODS IMPORTANT PROPERTIES : WELDABILITY

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Steel
info **SteelConstruction.info**
The free encyclopedia for UK steel construction information

- ▶ “All structural steels are essentially weldable. However, welding involves locally melting the steel, which subsequently cools. The cooling can be quite fast because the surrounding material, e.g. the beam, offers a large 'heat sink' and the weld (and the heat introduced) is usually relatively small. This can lead to hardening of the 'heat affected zone' (HAZ) and to reduced toughness. The greater the thickness of material, the greater the reduction of toughness.
- ▶ The **susceptibility to embrittlement also depends on the alloying elements principally, but not exclusively, the carbon content. This susceptibility can be expressed as the 'Carbon Equivalent Value' (CEV), and the various product standards for carbon steels standard give expressions for determining this value.**”

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

MODEL MATCHING : CRITERIA

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- ▶ Shape
- ▶ Size
- ▶ Grade defined by standard, not test certificates
 - Minimum yield strength (not tensile strength)
 - Weldability : chemical elements/carbon equivalent specified

MODEL MATCHING ESTABLISHING GRADE

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Structural Steel – Are You Getting What You Need?

“When Grade A is not A-grade”

Engineers Australia, Risk Engineering Society
Brisbane, 27 October 2015

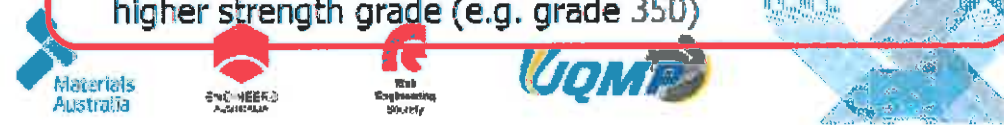
<https://www.engineersaustralia.org.au/portal/event/structural-steel-are-you-getting-what-you-need>

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“Grading by selection”

- ❖ Attempts by a supplier (onseller) to sell a batch of steel as compliant with a given grade:
 - Based only on the results of some tensile tests
 - Without a manufacturer’s mill certificate certifying that their product satisfies all requirements of the standard grade (e.g. AS/NZS 3679.1 - Grade 350)
- ❖ Two forms of this practice:
 - Grading by test: Supplier does not have a mill certificate, but has obtained some tensile tests from the batch
 - Up-grading: Supplier has a manufacturer’s mill certificate stating one strength grade (e.g. grade 300) but supplier claims that the actual batch meets the requirements of a higher strength grade (e.g. grade 350)

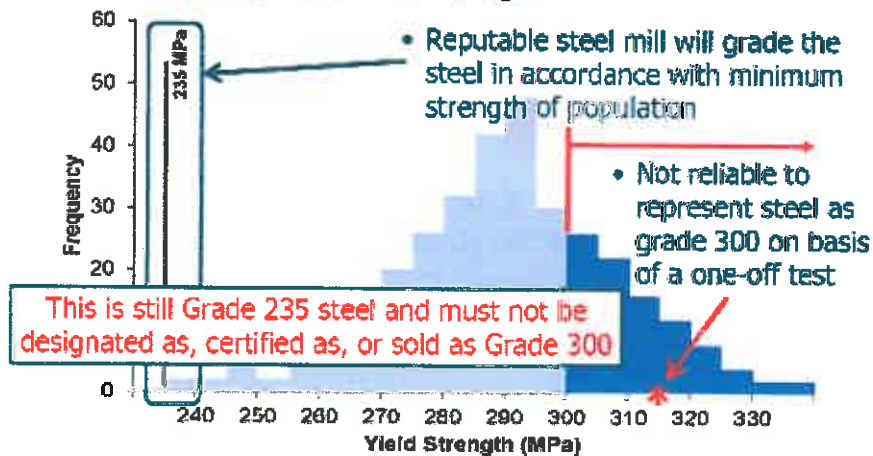


MEMBER OF
GFG
ALLIANCE

MODEL MATCHING ESTABLISHING GRADE

Grading by test

- ❖ In a typical steel mill, single heat 100+ tonnes
 - Rolled to give ~3000m of product
 - Statistical distribution of strengths

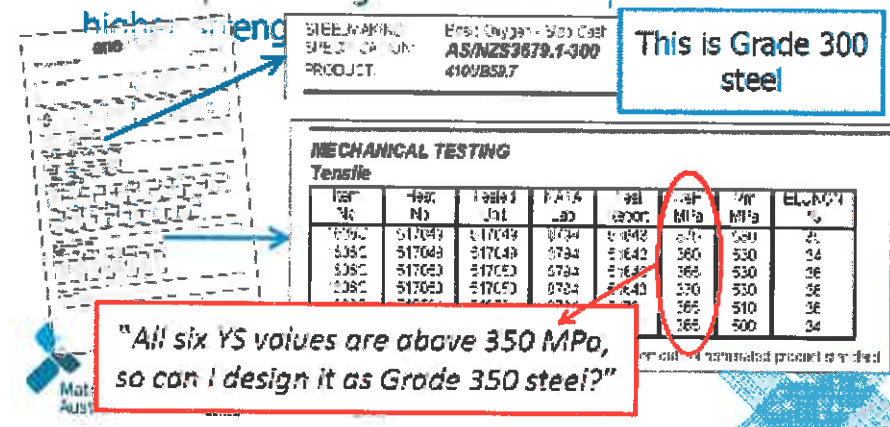


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Up-grading

- ❖ Supplier has a manufacturer's mill certificate stating one strength grade (e.g. grade 300)
- ❖ But tensile test values on that certificate suggest that the batch might meet the requirements of a higher strength grade (e.g. grade 350)

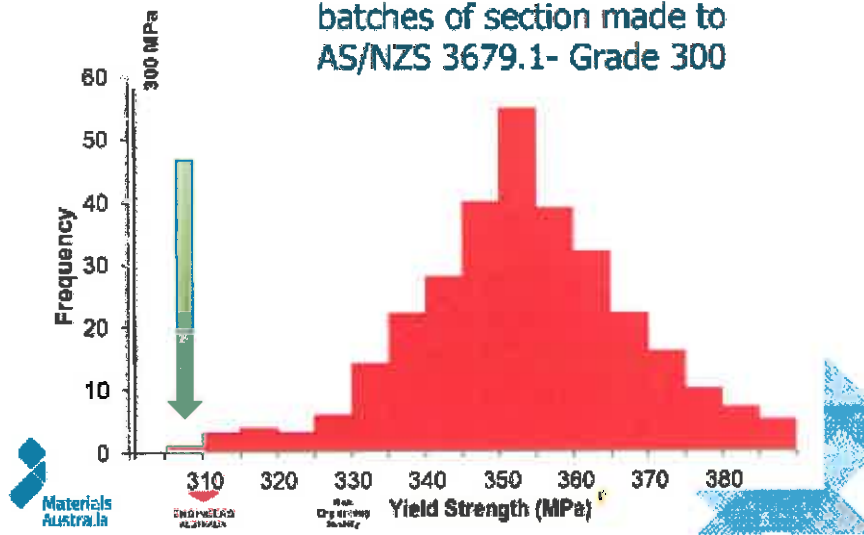
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MODEL MATCHING ESTABLISHING GRADE

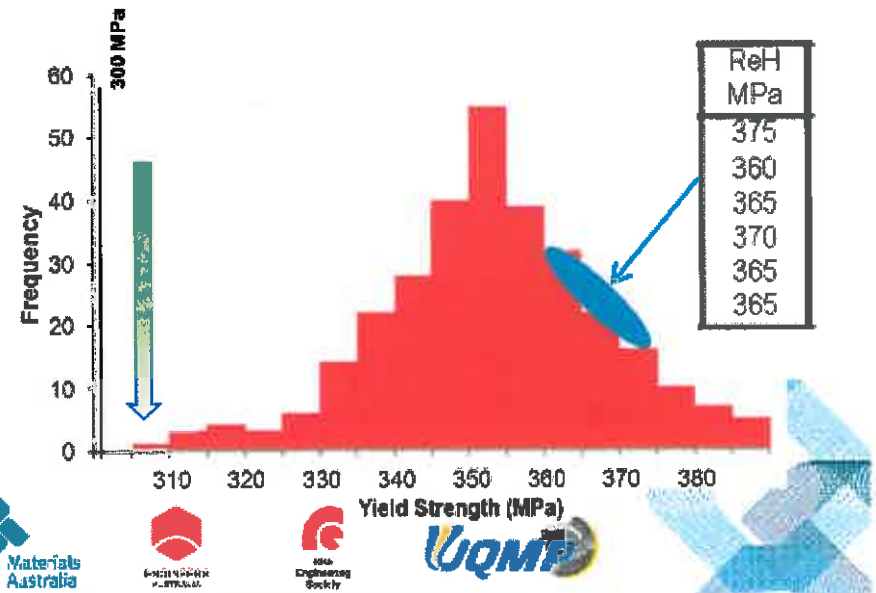
Up-grading

❖ Typical distribution of YS values of different batches of section made to AS/NZS 3679.1- Grade 300



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Up-grading



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MODEL MATCHING ESTABLISHING GRADE

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Up-grading

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- ❖ Yield strengths all above 300MPa, and go up as high as 400MPa in a normal Gaussian distribution
 - Results shown on the test certificate came from the area shaded blue on the diagram
 - But other results will go higher, others lower
 - All results are above 300 MPa, as the standard requires, but almost half will be under 350 MPa
- ❖ So, despite the fact that the results on the test certificate were all above 350 MPa, this is still Grade 300 steel and must be designed as such

Grading by selection

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- ❖ A small sample of test results
 - Likely not to capture the full distribution of values within a given batch
 - Even more probably will not capture the full distribution of values within a given mill heat
 - Certainly does not capture the distribution of values produced from a series of heats over time



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CASE STUDY : MODEL MATCHING

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Shipment of

[REDACTED]
to Australia

- Grade:
AS/NZS 3679:2010
Grade 300
- Thickness

[Confidential : Actual shipment details & test results]

Results :

1. Yield Strength



2. Chemistry



2. Tensile Strength



[Confidential : Actual shipment details & test results]

[Standard requirements]

Results :

1. Yield Strength

➤ 280MPa

2. Chemistry

➤ CEQ<0.44

2. Tensile Strength

➤ Min 440MPa

Even though these test results meet the requirements for Grade 350, the sections cannot be classified as such, the batches these tests represent are only certified to meet Grade 300 requirements.

**GRADES SS400 AND SM400A/B DO NOT
MEET THE MINIMUM YIELD STRENGTH
(OR CHEMISTRY) REQUIREMENTS FOR
GRADE 300.
GRADE SM490A DOES.**

[Standard requirements]

For AS/NZS 3679.1 Grade 300:

1. Yield Strength

➤ >280MPa

- SS400 : >235MPa ok ☒
- SM400A/B : >235MPa ok ☒
- SM490A : >315MPa ok ☑

2. Chemistry

➤ CEQ <0.44

- SS400 : no chemistry spec, only impurity limits – grade for “general structures” not “welded structures”. ☒
- SM400 and SM490A max spec similar for C, Mn. ☑

3. Tensile Strength

➤ >440MPa

- SS400 : 400-510 ☒
- SM400A/B : 400 – 510 ☒
- SM490A : 490-610 ☑

REVIEW OF ANTI-DUMPING MEASURES REPORT INTO HOT ROLLED STRUCTURAL STEEL SECTIONS FROM KOREA, TRADE MEASURES REPORT NO 79 AUGUST 2004



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“That review observed that the exports to Australia were grade RL and the domestic grades were SB and SK (HK).”

Grade	Standard	Specificat ion	Mpa
RL	AS 3679.1		280 – 320
SB	KS D 3503	SS 400	215 - 245
HK	KS D 3515	SM 490A	285 – 325

“Customs found the specifications of the exported grade RL and domestic grade HK to be very similar, and considers the grade **HK is the most appropriate for comparison with the exported grade RL**. Customs calculated normal values using domestic sales of only grade HK.”

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[Model matching approach based on tensile strength advocated by
Hyundai Steel in Investigation 223]

MODEL MATCHING : INV 223

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[Commission's assessment of model matching in Investigation 223]

[Commission's assessment of model matching in Investigation 223]



NOT the correct test : should be checking whether Grade SS400 or Grade SM490A meet the minimum requirements to be sold as Grade 300. This should be based on Standards Comparison, material selection for structural design work NOT based on test certificates.



HYUNDAI STEEL PRODUCTS

“Sections are made by rolling after heating at minimum 1,000°C beam blank, bloom and billet of semi-finished products manufactured by going through continuous casting with molten metal made by melting iron scrap into the **electric arc furnace**.”



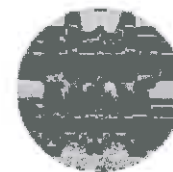
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Ingot for Forging



Heavy Machinery



COIL



Stainless Steel



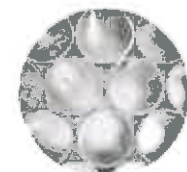
Hot Rolled Steel



Cold Rolled Steel



Steel Plate



ERW Pipe



Automotive Parts



Reinforcing Bar



Section



Special Steel

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HYUNDAI STEEL PRODUCTION

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South Korea's Top Steel Producers in 2016			
Rank	Company	Production (mmt)	Main Products
1	POSCO	41.6	Hot-rolled, cold-rolled, plate, stainless, electrical, wire rods
2	HYUNDAI Steel Company	20	Beams, reinforcing bars, hot-rolled, plates
3	Dongkuk Steel Mill Co, Ltd	3.3	Plates, sections, bars

Source: World Steel Association; Hoovers; MarketLine

“Hyundai Steel is the world's second largest EAF steel producer.”

“The total annual capacity of the company reaches 24 million tonnes per annum including two EAF plants of Incheon and Pohang ex-Gangwon industrial plant.”

<https://www.revolvy.com/main/index.php?s=Hyundai%20Steel>



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HYUNDAI ACRS ACCREDITATION – MAY 2015

[Extract : ACRS certificates]

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ADJUSTMENTS

Verification report Hyundai – INV 223 – pg 53

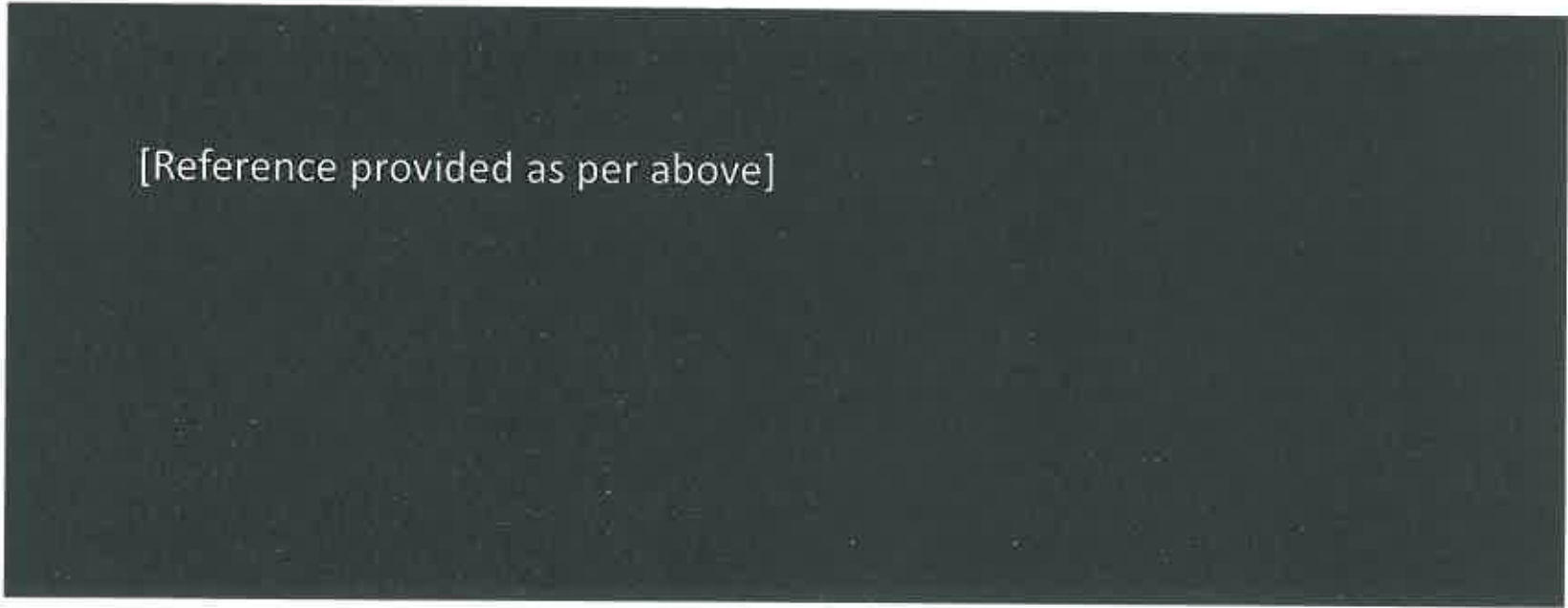
[Reference provided as per above]

ADJUSTMENTS

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Verification report Hyundai – INV 223 – pg 54



[Reference provided as per above]



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LEVEL OF TRADE

Verification report Hyundai – INV 223 – pg 52

[Reference provided as per above]

DATE OF SALE?

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Verification report Hyundai – INV 223 – pg 20

[Reference provided as per above]

QUESTIONS?

