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INTRODUCTION of SAIJO FACTORY & Coke Drum Technology

September 2009

Sumitomo Heavy Industries, Ltd.

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Sumitomo Heavy Industries, Ltd.

Sumitomo Heavy Industries, Ltd.

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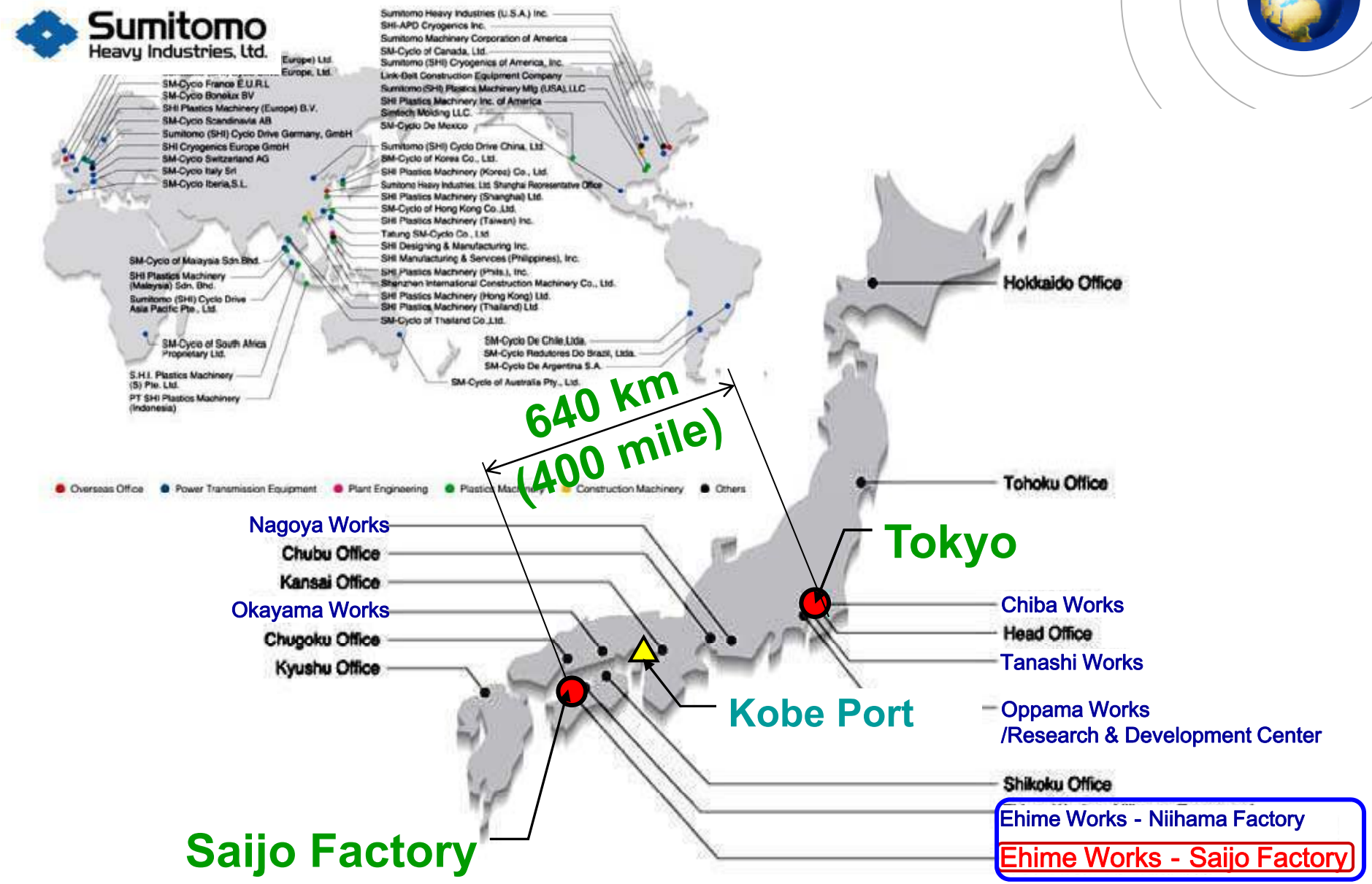
SAIJO Factory Profile : Location



SAIJO Factory Profile : History

Sumitomo Heavy Industries, Ltd.

1973 **Established as a manufacturing base for large steel products**

1974 **Obtained U & U2 Stamps of ASME**

1984 **Attained 100 unit ASME Stamped Products**

1989 **Concentrated on Reactors and Coke Drums**

1993 **Obtained ISO 9001 certificate**

1996 **Concentrated on Coke Drum Manufacturing**

1999 **Obtained ISO 14001 certificate**

2006 **Fabricated 100th Coke Drum**

2009 **Total Coke Drums Awarded Since 1973 = 176!**

SAIJO Factory Profile : Brief Introduction

Sumitomo Heavy Industries, Ltd.

2.Experience & Capability

- World-wide Delivery
- Coke Drum Weight & Size
- Materials of Coke Drum
- Site Assembly
- Field Services

Experience & Capability : World-wide Delivery

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176 Coke Drums Delivered Throughout the World

(As of August 2009)

Experience & Capability : Coke Drum Weight & Size

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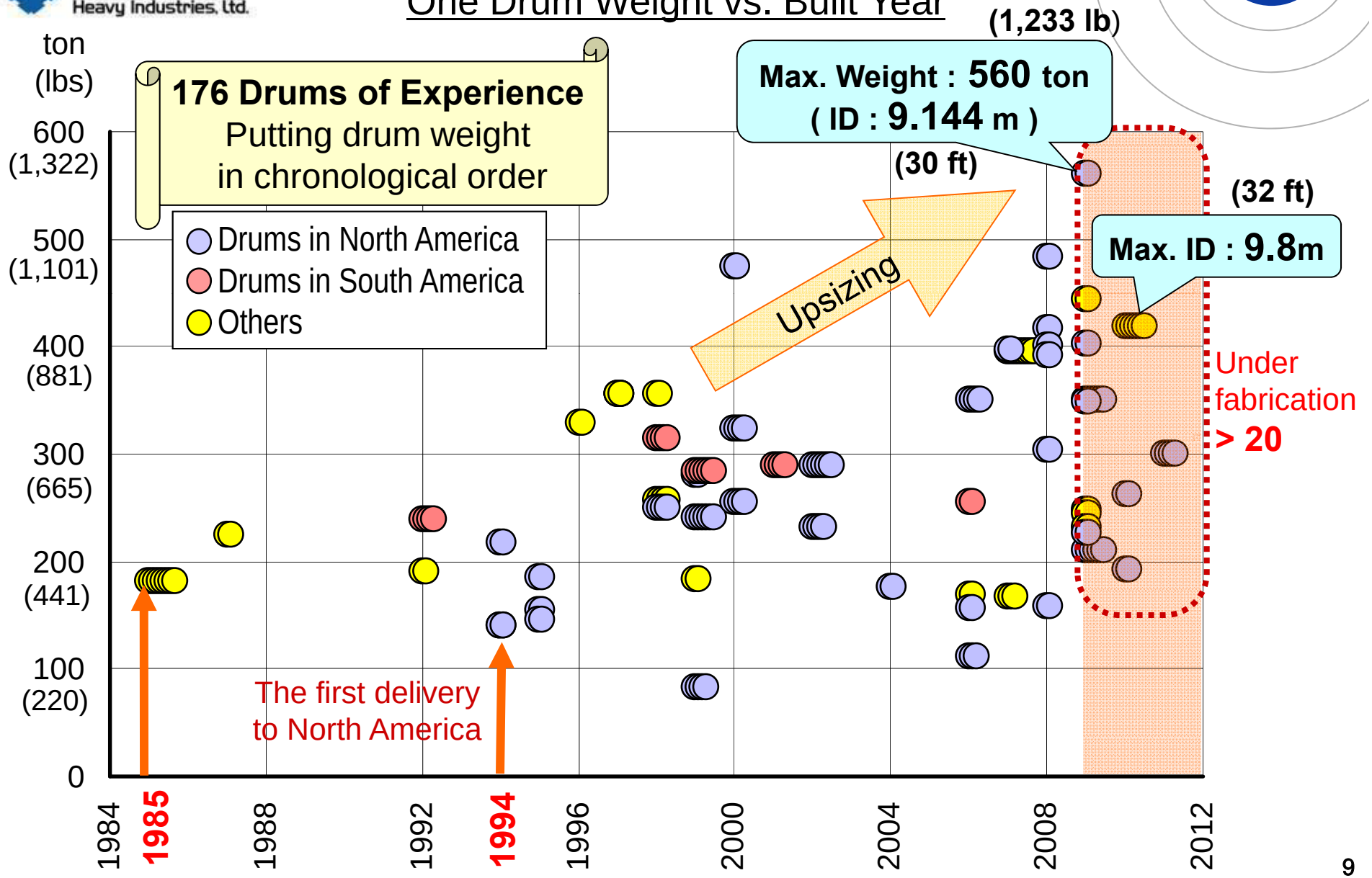
One Drum Weight vs. Built Year



Experience & Capability : Materials of Coke Drum

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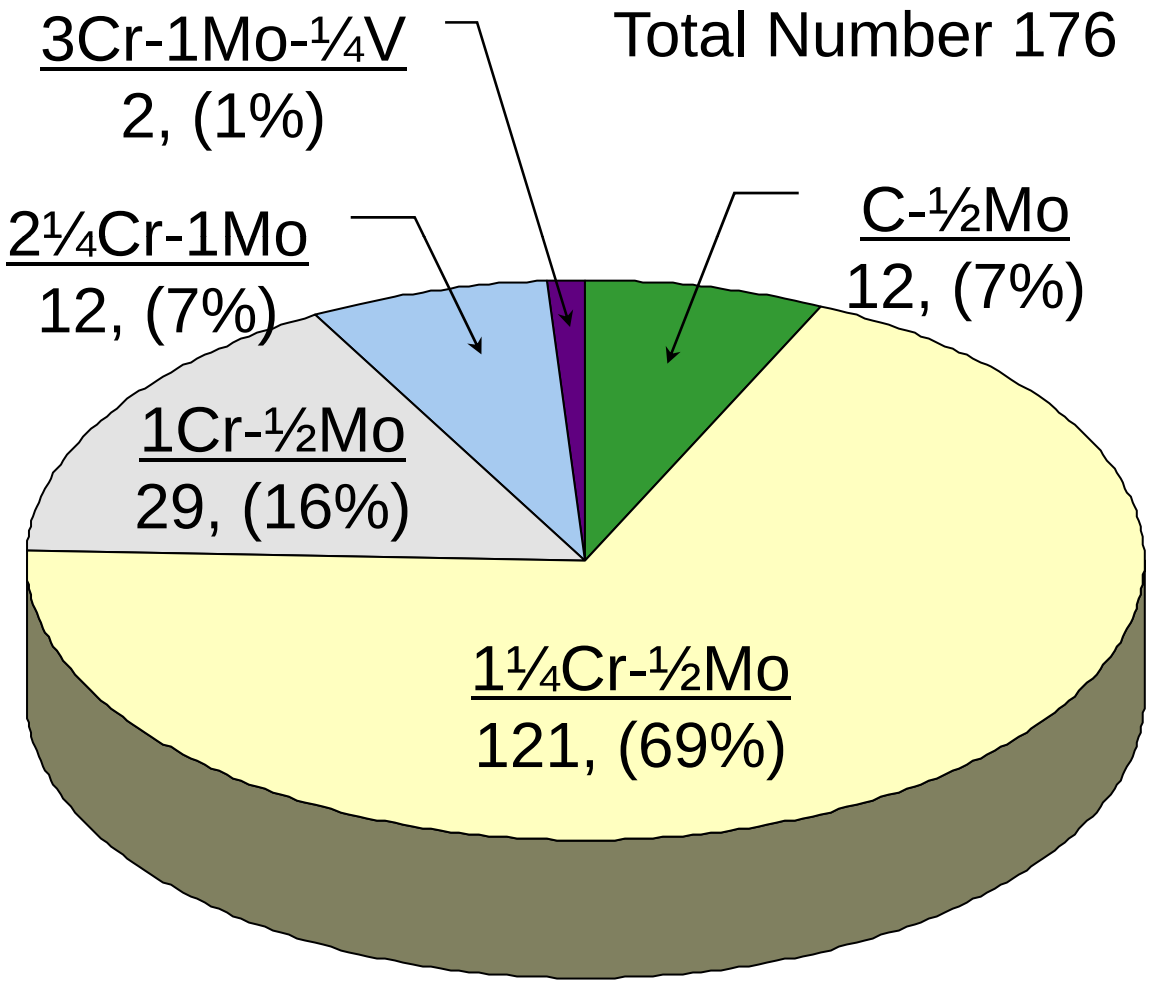
Fabrication Experiences of Coke Drums for Individual Base Materials



Experience & Capability : Site Assembly

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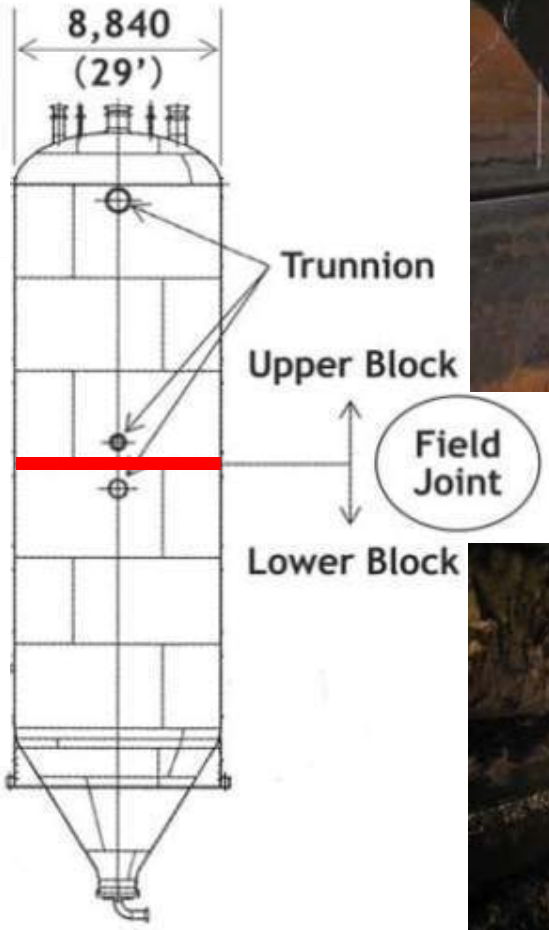
Assembling Experience in South America

Shipping

*** Surface Transportation**

*** Erection**

* Both processes are out of Sumitomo's scope



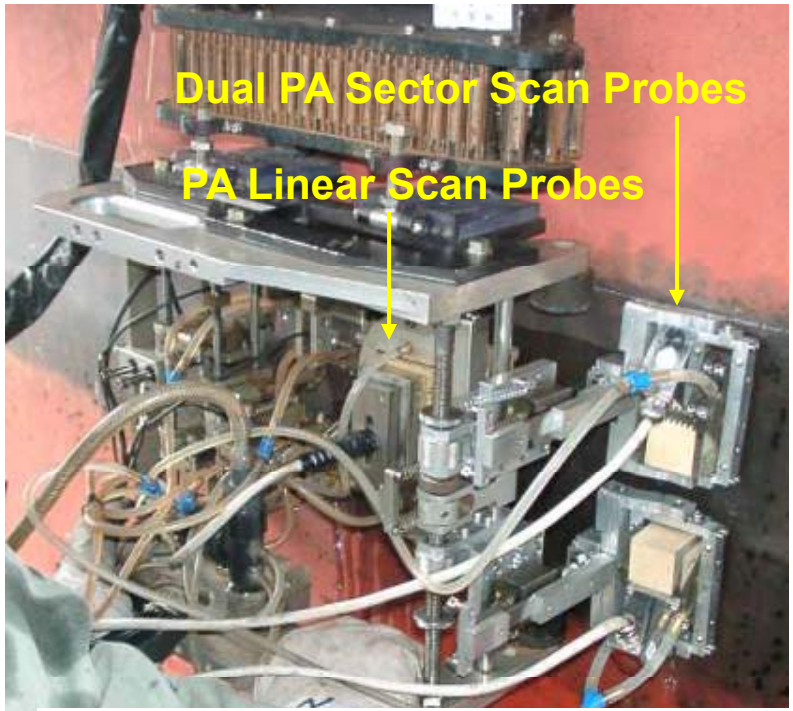
Fit-up

Field Welding

Experience & Capability : Field Services

In-Service AUT Inspection for Coke Drum

Detection and Accurate Height Sizing by Phased Array for Fatigue Cracks in the Clad Restoration Weld and its Heat Affected Zone during operation.



◆**S.H.I. EXAMINATION & INSPECTION, LTD.**

A Subsidiary of Sumitomo Heavy Industries, LTD.

Sumitomo Heavy Industries, Ltd.

3. Cutting Edge Techniques

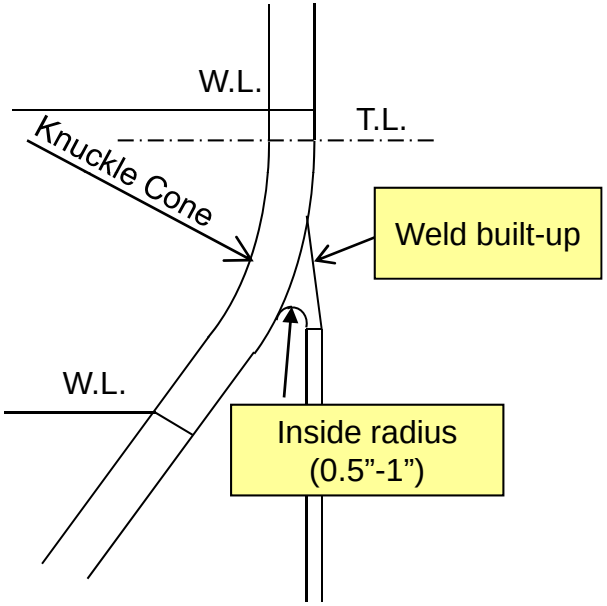
■Integral Skirt Design

To bring longer fatigue life by utilizing Sumitomo's large scale facilities

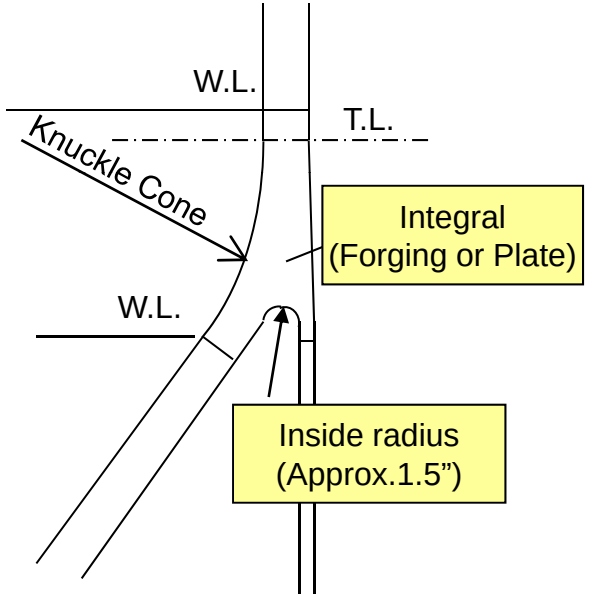
Cutting Edge Techniques : Integral Skirt Design

Sumitomo Heavy Industries, Ltd.

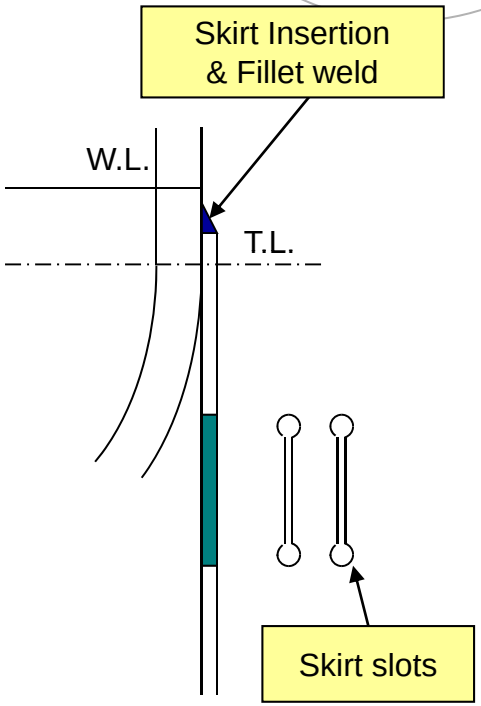
SHI's Recommendation



Weld built-up type



Integral type
(Forged Bar or Thick Plate)



Insertion type

Cutting Edge Techniques : Integral Skirt Design

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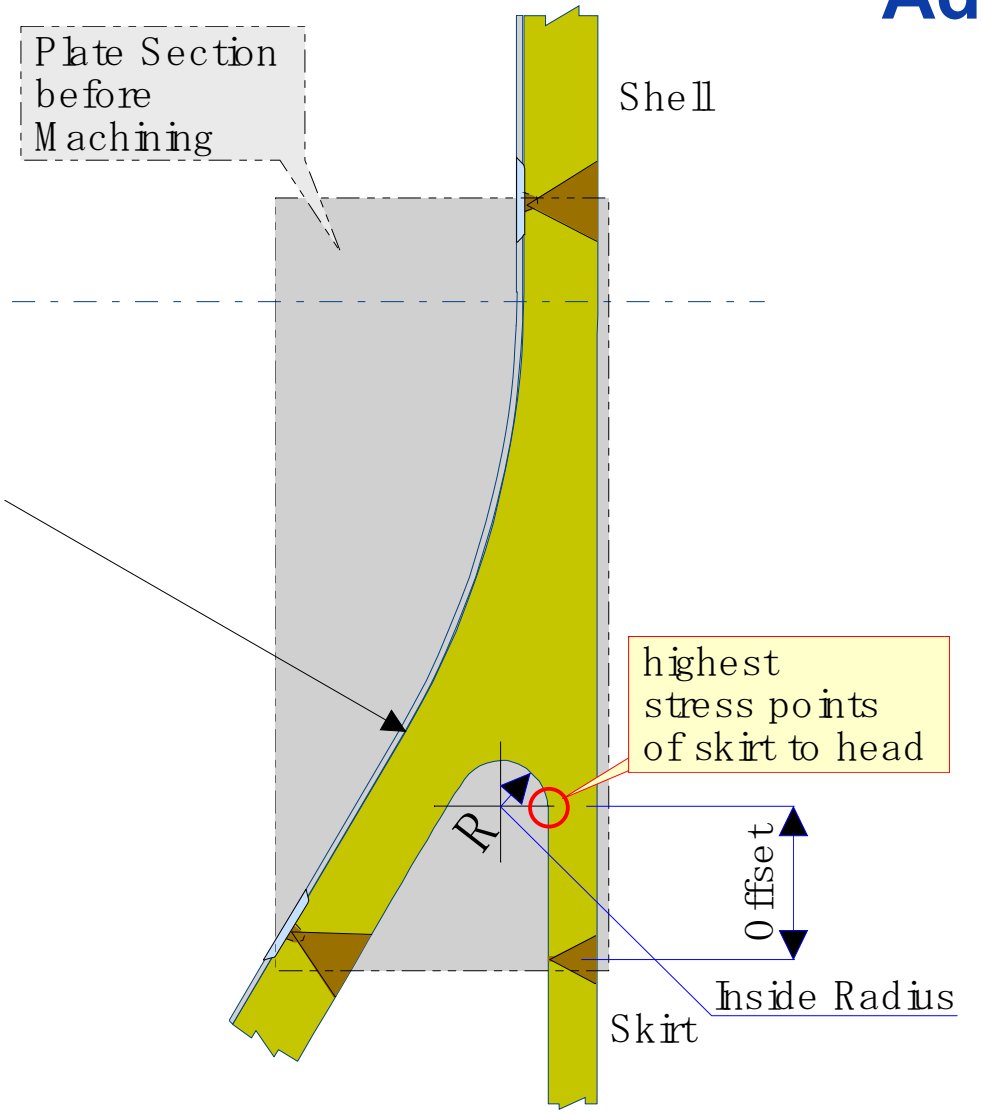
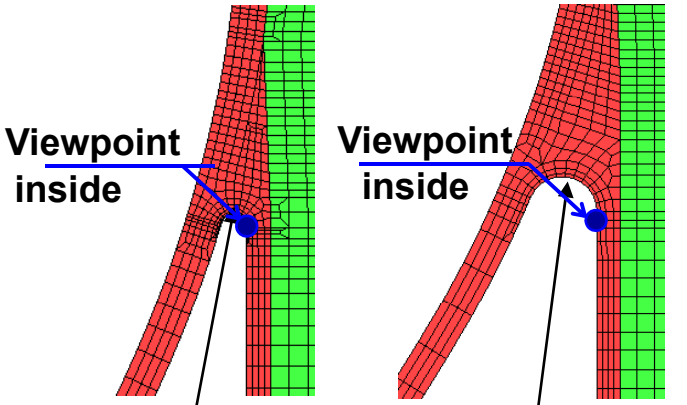


Advantage

・ To make a large r inside radius

⇒Longer Fatigue Life



Conventional Type, R=13mm	Integral Type, R=38mm
3,060Cycle	6,200 Cycle

Extending about twice the fatigue life

Cutting Edge Techniques : Integral Skirt Fabrication

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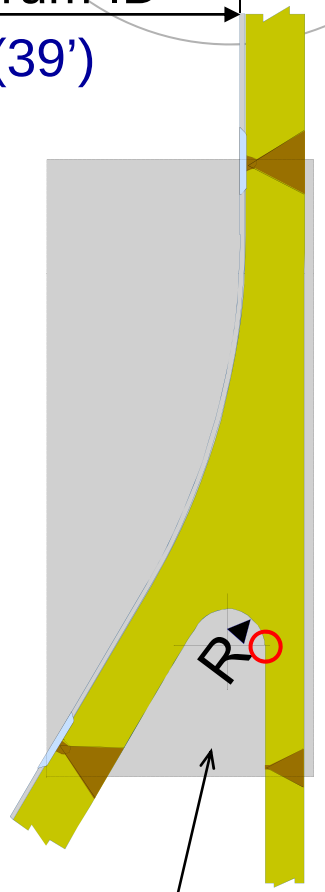
Fabrication Experience of the Integral Skirt

Drum ID

Applicable Max. ID = 12,000mm (39')

Built Year	Drums	Drum ID	Inside Radius of the Skirt Attachment
1992	2	7,620 mm (25')	20 mm (0.8")
2002	6	8,484 mm (27.8')	35 mm (1-3/8")
2006	2	6,400 mm (21')	30 mm (1-1/8")
2007	3	6,100 mm (20')	25 mm (1")
2009	2	7,620 mm (25')	30 mm (1-1/8")
2009	2	6,400 mm (21')	30 mm (1-1/8")
(2010)	2	6,096 mm (20')	35 mm (1-3/8")
	Σ19		



Original Rectangular Material

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4. Research & Development

■Skirt Attachment Examination

To establish innovative skirt structures by the experiment

■Improvement in Welding Material

(Strength Matching of Welding Metal)

To help shell to less bulge by controlling the weld metal strength

R&D : Skirt Attachment Examination

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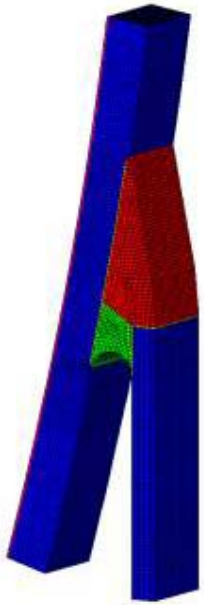
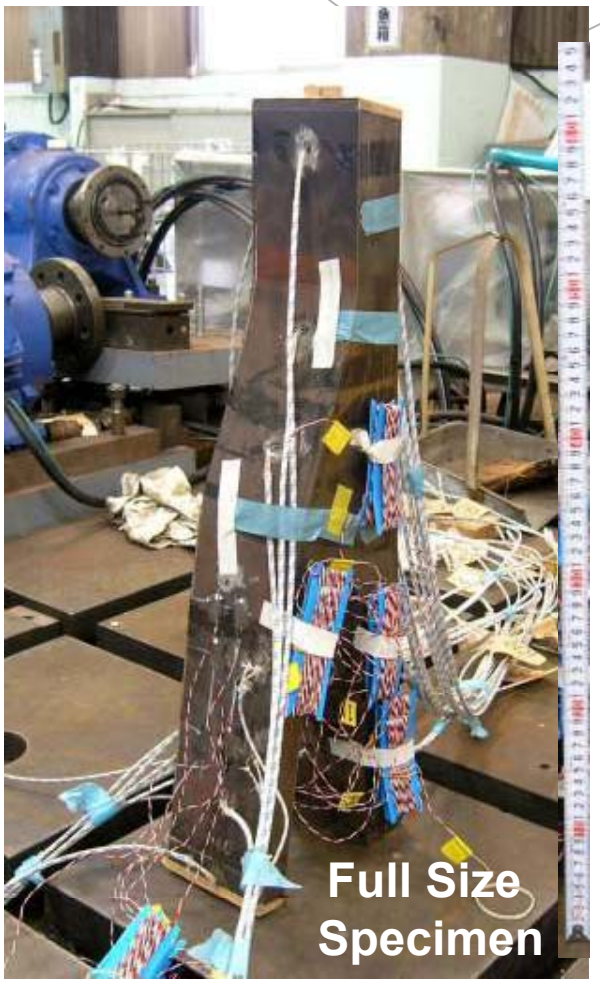
Static Loading Test and Thermal Test

FEA Modeling



Static loading test

Thermal test

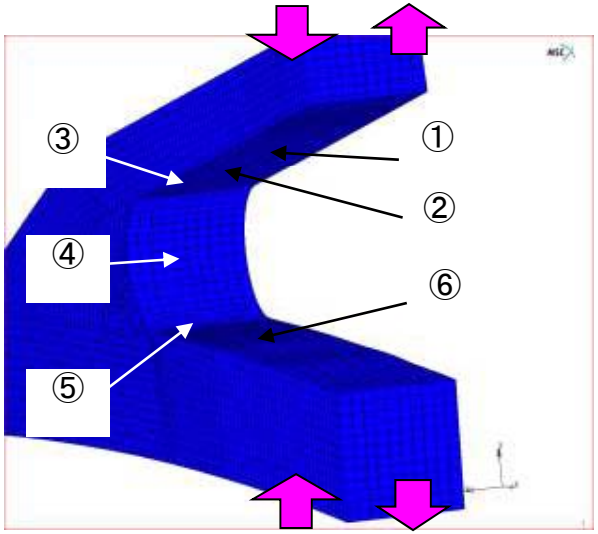


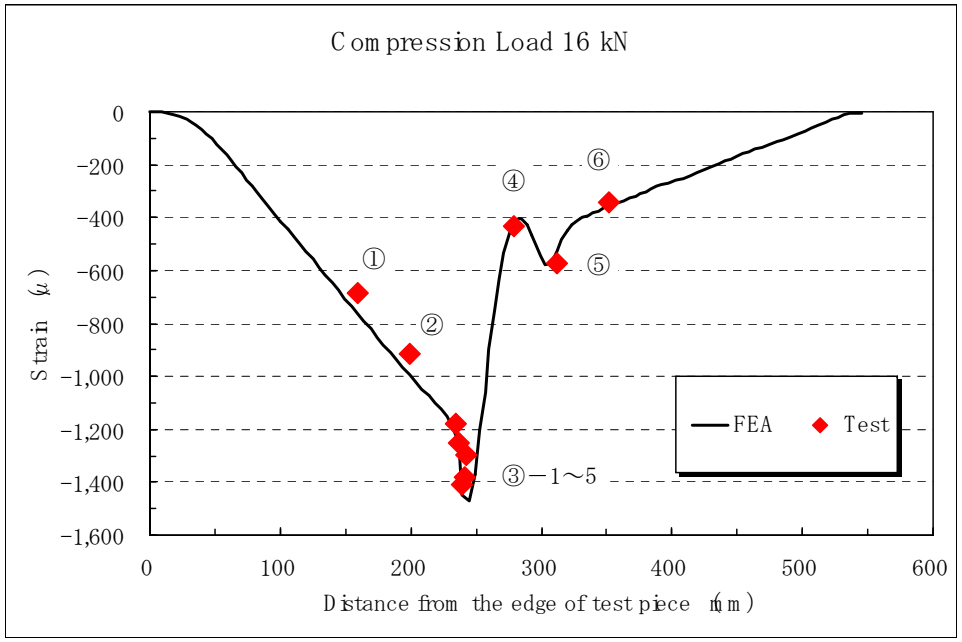
Thermocouple & high temperature strain gauge

- **Actual** strength measurement based upon various experiments
  (Static, Thermal and Fatigue)
- **More Accurate** FEA Study verified by the experimental data

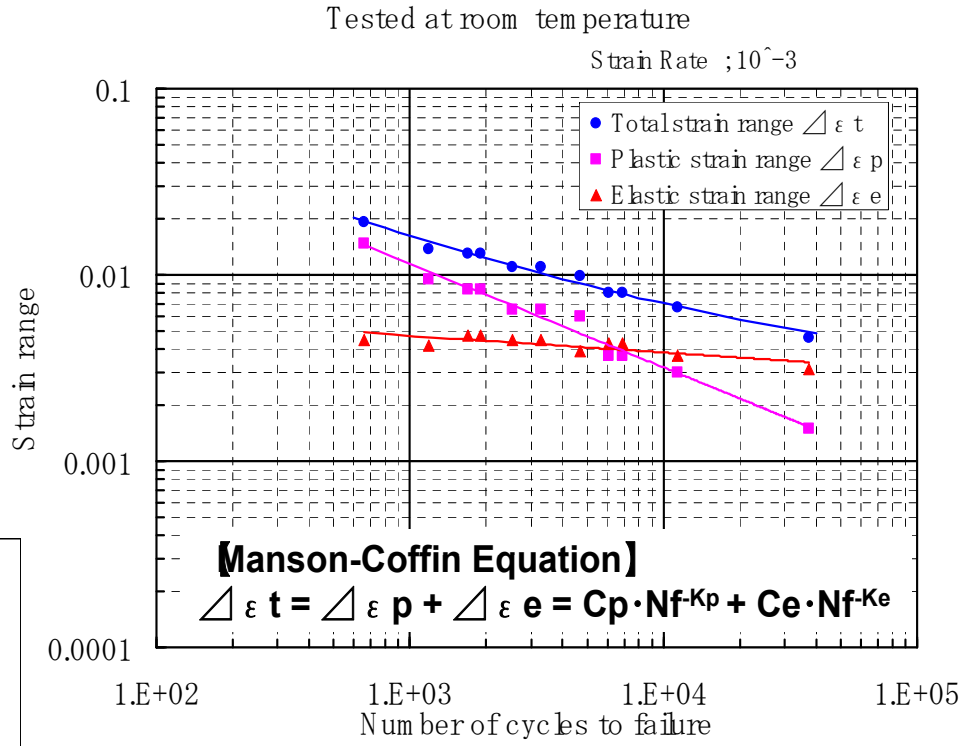
R&D : Skirt Attachment Examination

Static loading test verification of FEA

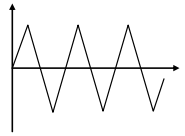




Setting for fatigue curve



Test Condition

Waveform 	Strain control ; under zero mean strain Waveform ; triangular
Strain rate (S^{-1})	10^{-3}

R&D : Improvement in Welding Material

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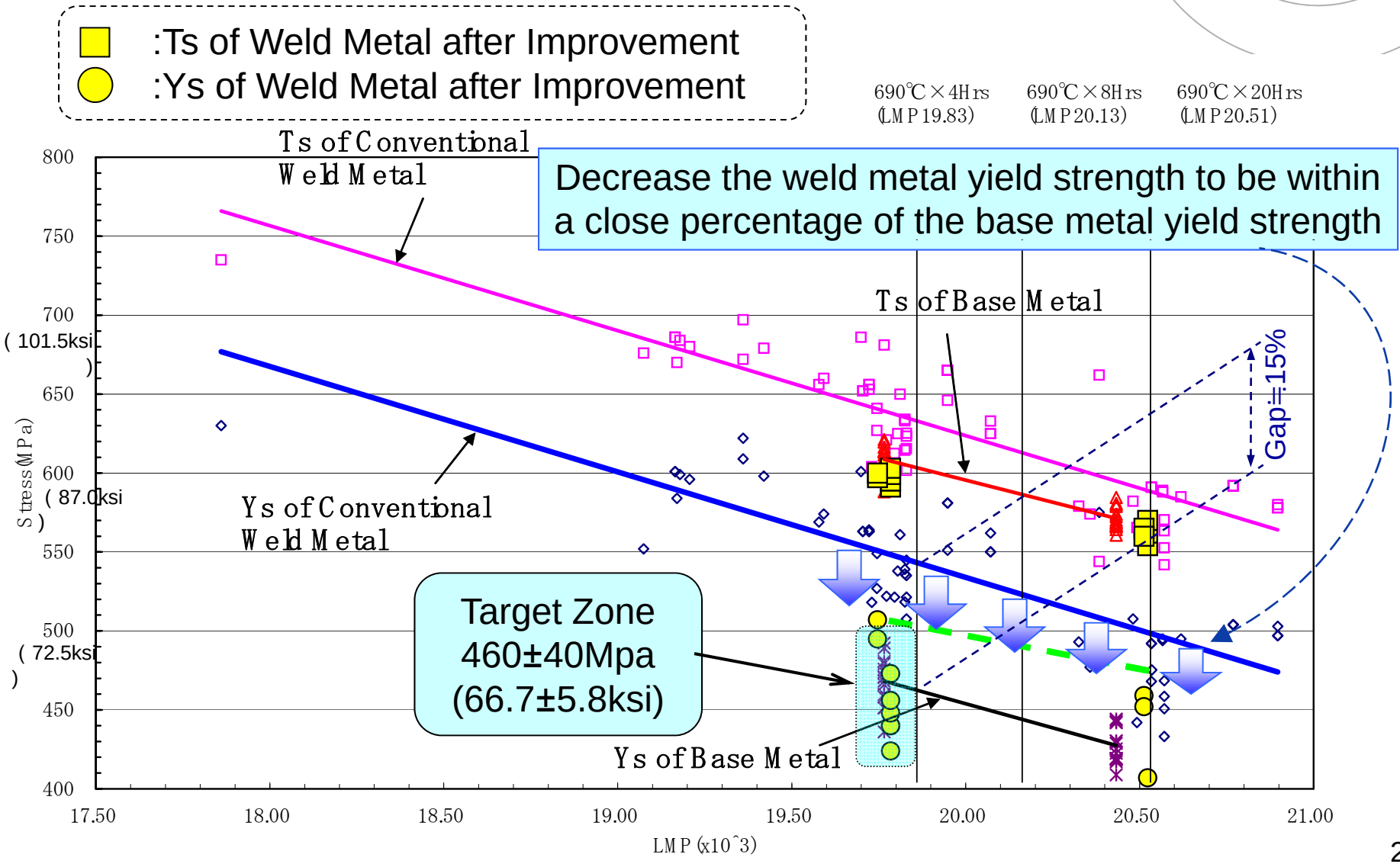
Developed welding materials for 1¼Cr-½Mo to lower the yield strength of the weld metal



Questions Welcomed

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Thank You !

Sumitomo Heavy Industries, Ltd.