Netanya-Plasmatec Ltd.

Israeli start-up that developed world-wide patented process to improve Gravity Die Casting which:

- **Saves in production costs.**
- **Improves quality.**
- **Reduces environmental pollution**

Presenting:

- **Dan Yardeni** - Partner and Chairman of the Company.

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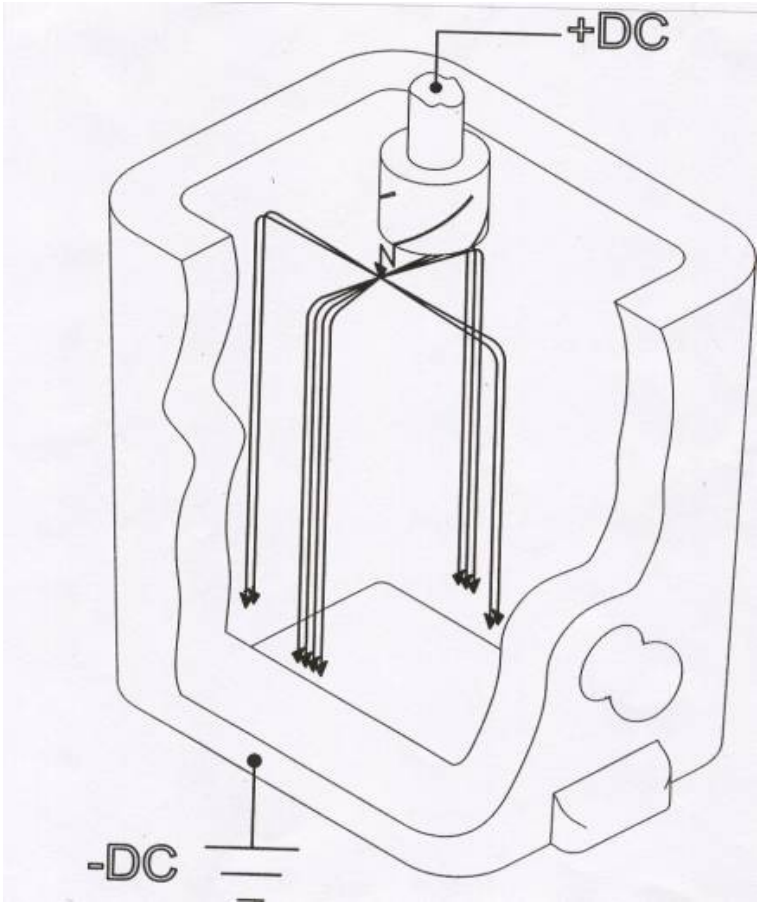
What is the PTC process?

It applies a rotating plasma arc over the molten metal during its solidification in mold.

The rotating plasma arc moves along a path defined by graphite electrode.

The electrode Does Not touch the metal.

The process Does Not heat the metal.



The PTC Electrode

Tip of the electrode used for casting automotive Aluminum Cylinder Heads

Length – 350 mm (~ 14”)
Diameter – 40 mm (~1.5”)

Plasma stirring effects:

Creates changing current density flow in the molten metal.

↓

Induces electric and magnetic fields in the molten metal.

↓

Strong stirring creates shear forces and improve feeding.

↓

<u>Risers being replaced by kinetic energy.</u>

↓

Reduces gross casting weight by 30-40%.

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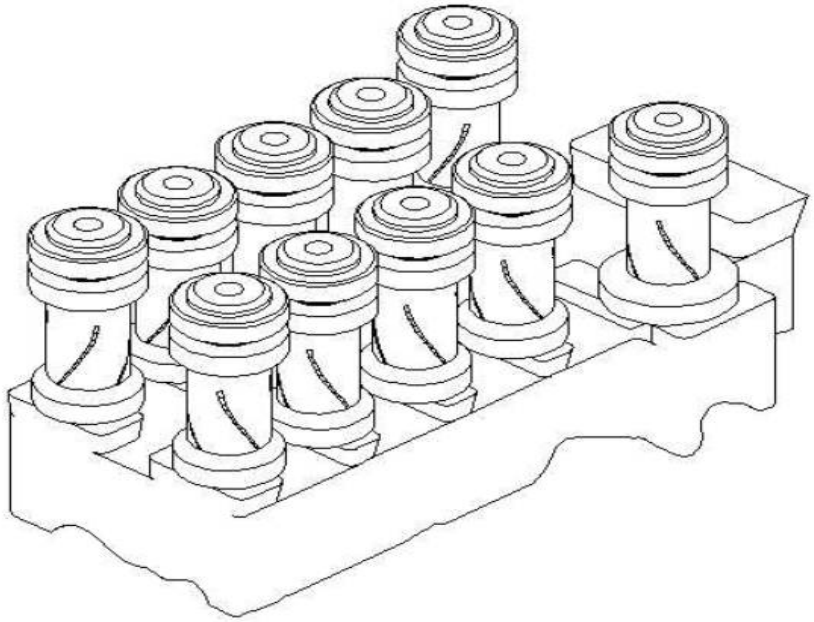
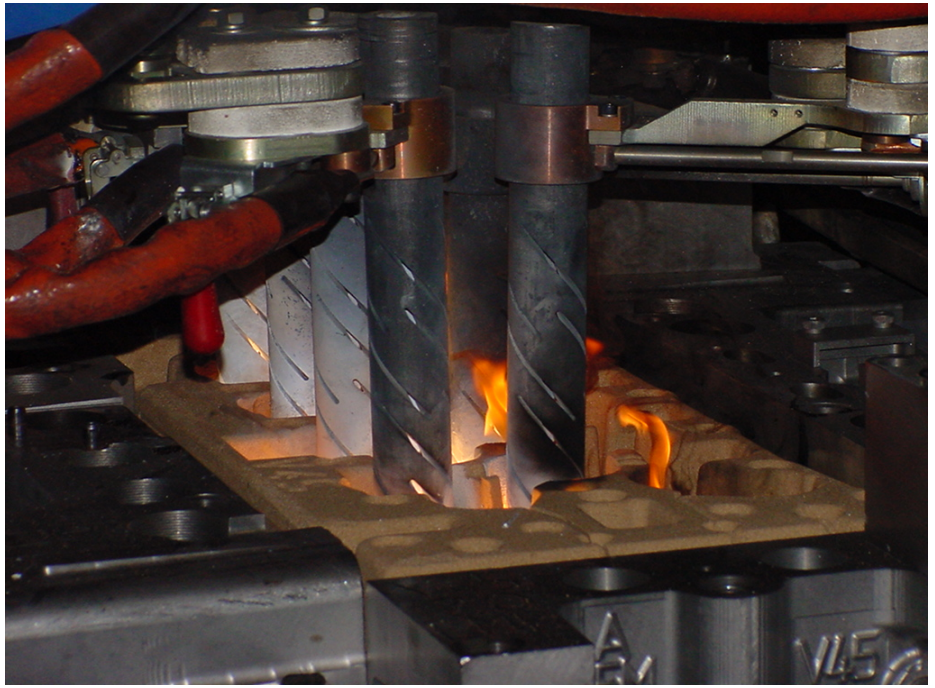
PTC system for complex casting shape of cylinder head





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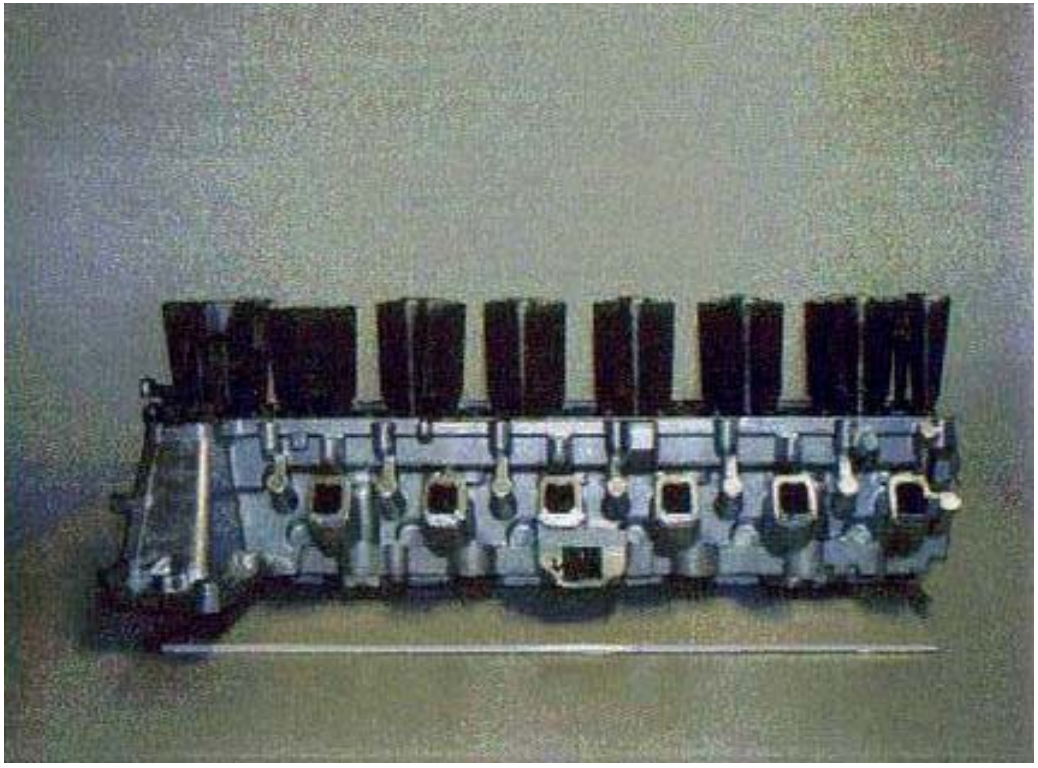
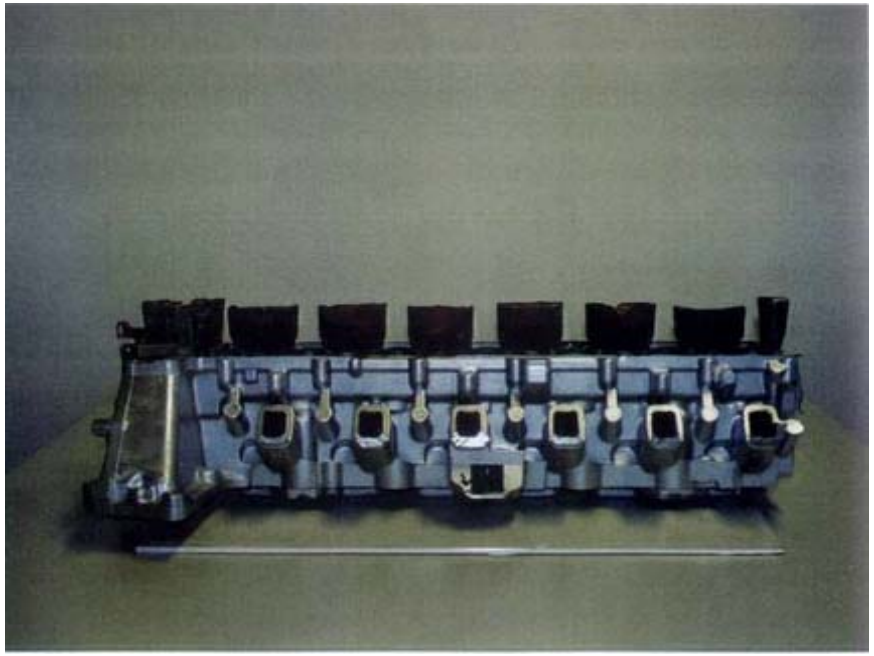
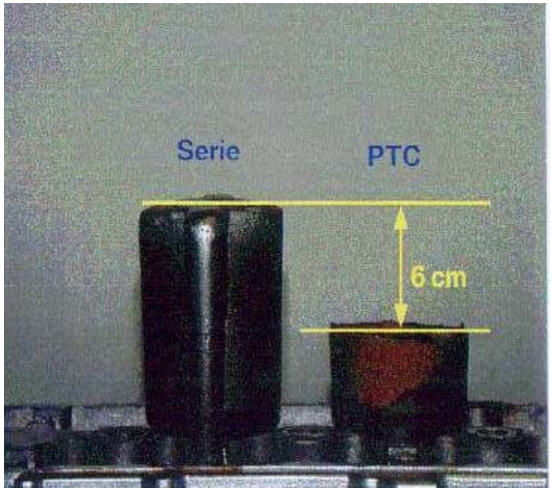
“As cast” Conventional Cylinder Head
42 kg Weight



Same Cylinder Head
Cast by the PTC Technology
weighing 29 kg → 13 kg less





Conventional GDC process

Tall Risers → compensate for metal shrinkage.

Risers weight ~ net product weight

Total casting weight is 42 kg.

End product weight is 23 kg

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PTC Savings for typical 15 kg net cylinder head

- **Over 30 % of Aluminum casting**
- **Over 35 % of sand and binders**
- **Increase production rate by 20-25 %**

Gross Casting Weight:
Conventional - 31kg PTC - 21kg

Top sand core
16kg → 6kg

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Benefits of the PTC process for Automotive Gravity Die Cast parts

- **Reduces the overall casting weight by 30-35%.**
- **Saves 30-40% of the sand cores and binders.**
- **Increases production rate by 25%.**
- **Saves at least 30% in CO2 emission.**

The process was tested and approved by European and Far Eastern producers and commercially applied.

Where is saves?

Direct savings in:

- Aluminum melting.
- Sand and additives reclamation.
- Increased production rate due to shorter cycle.
- Lower environmental penalties.

Indirect Savings:

- Improved Scrap ratio.
- Lower defects rate.

Required Capital Investment for; Average 20 kg Cylinder Head (6-8 electrodes) cast on stand-alone station (50,000 pcs. p.a,)

- Power supply
- Cables
- Control Cabinet and Panel
- Electrodes console
- Electrodes

The equipment is an add-on to existing casting lines

Total cost including engineering – **Euro 100,000**

Running Costs per casting an average Cylinder Head

- **Electrodes wear (1000 castings) – 0.25 Euro per casting**
- **1.5 kWh Electricity – 0.12 Euro per casting**

We claim for:

- Average saving of **1.0 Euro** for each 1 kg less in risers weight.
- Average saving of **0.5 Euro** for each 1 kg net weight of cylinder head.

Other products to be cast by the PTC process

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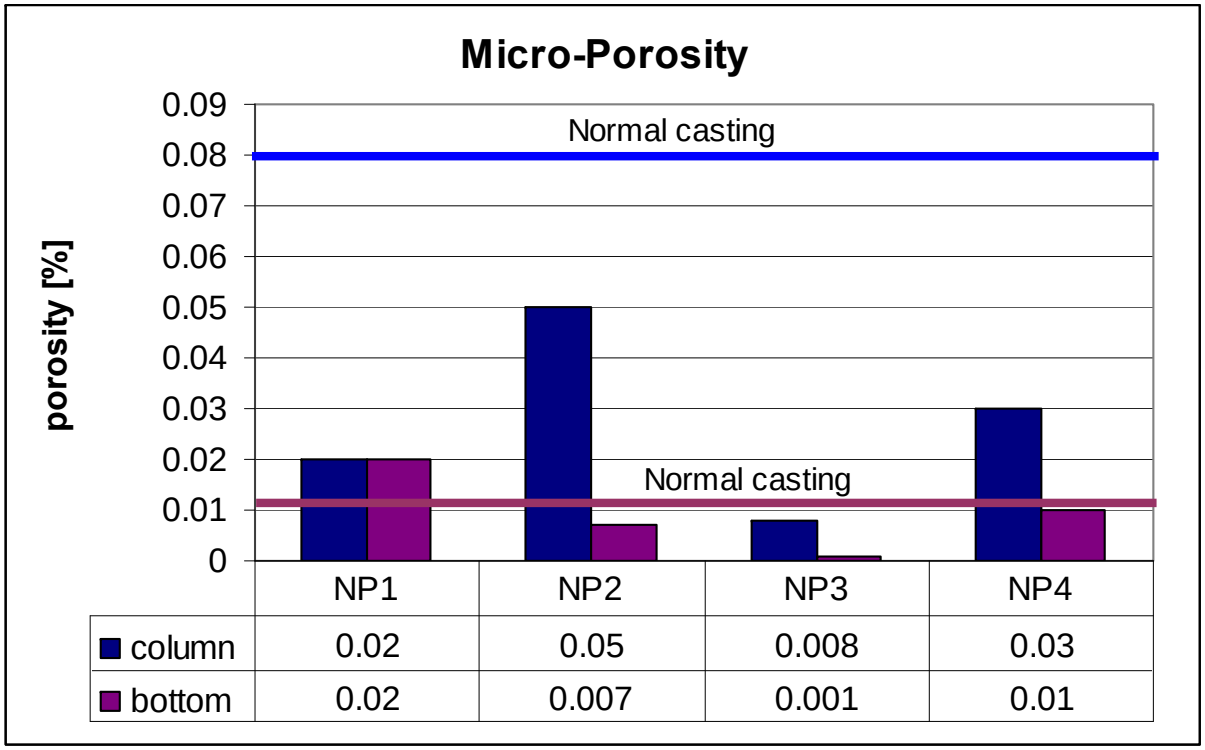
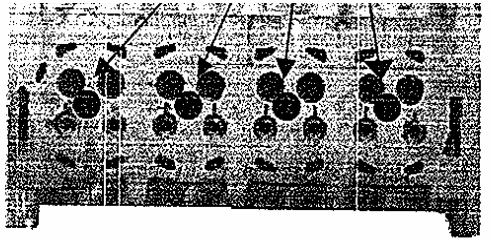
Quality Improvements in Cast Cylinder Heads

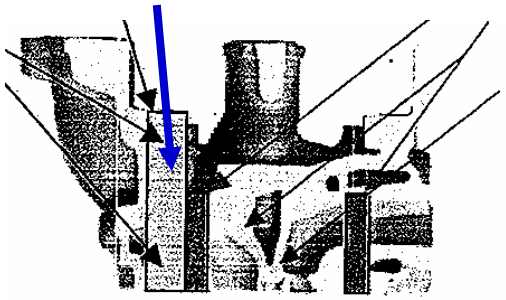


	NP1	NP2	NP3	NP4
column	0.02	0.05	0.008	0.03
bottom	0.02	0.007	0.001	0.01

Bottom of the casting:



Column:



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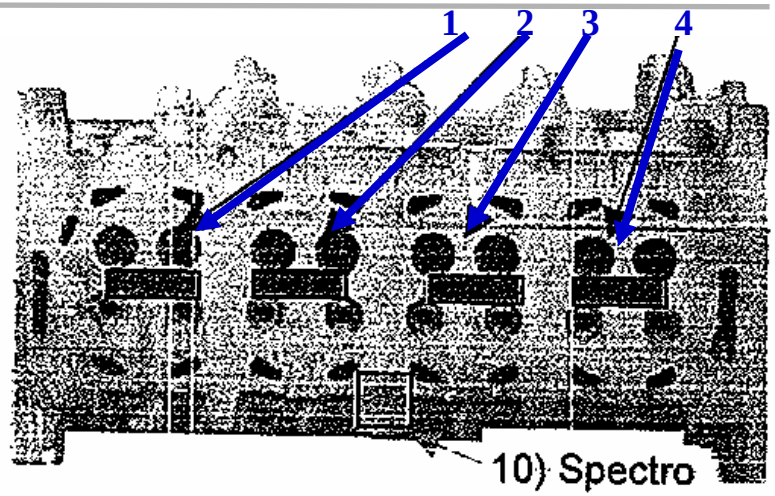
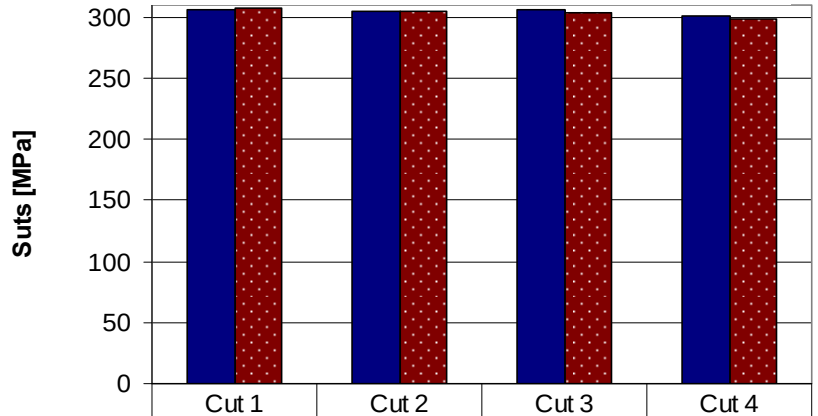
Mechanical properties at the bottom of the casting

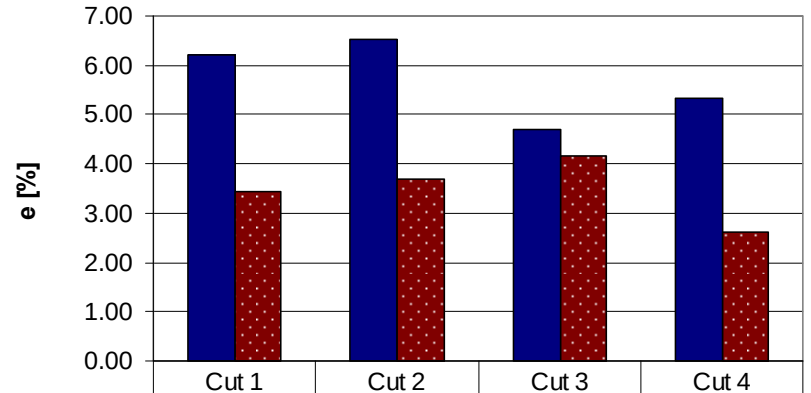


Ultimate tensile stress



	Cut 1	Cut 2	Cut 3	Cut 4
NP casting	306.67	305	306.33	301.5
Normal casting	307	305	304	299

Elongation



	Cut 1	Cut 2	Cut 3	Cut 4
NP casting	6.22	6.5275	4.69	5.315
Normal casting	3.44	3.68	4.17	2.62

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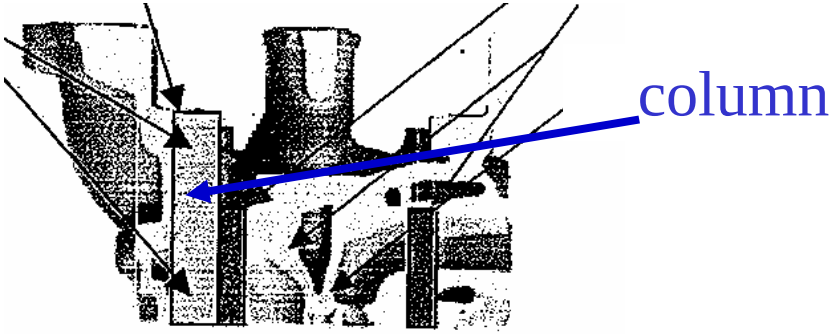
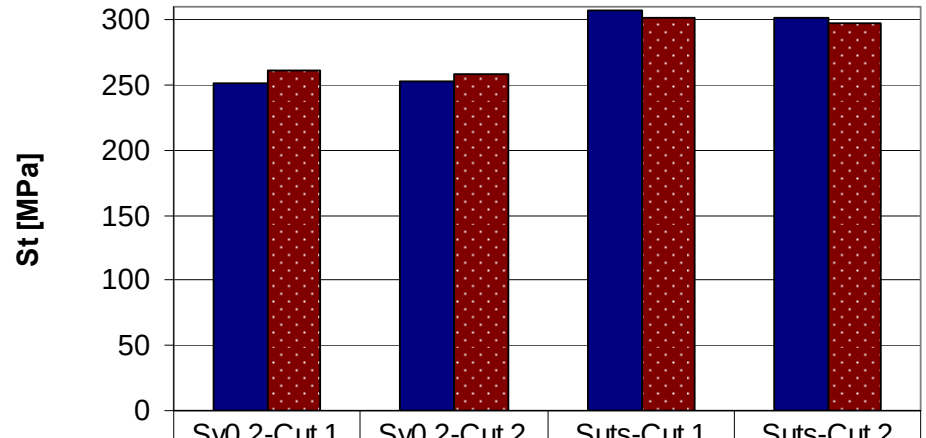
Mechanical Properties at the Column area

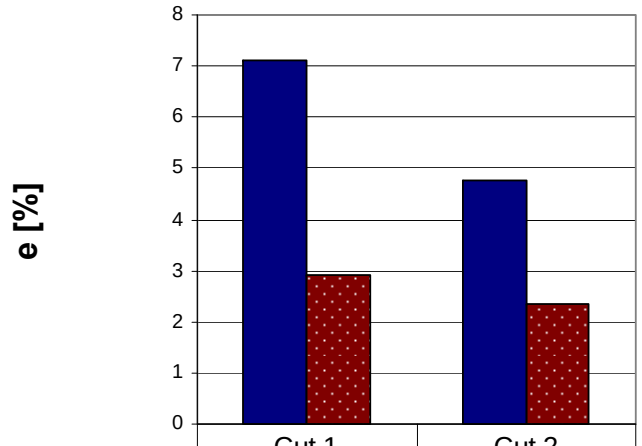


Tensile stress UTS and 0.2Sy



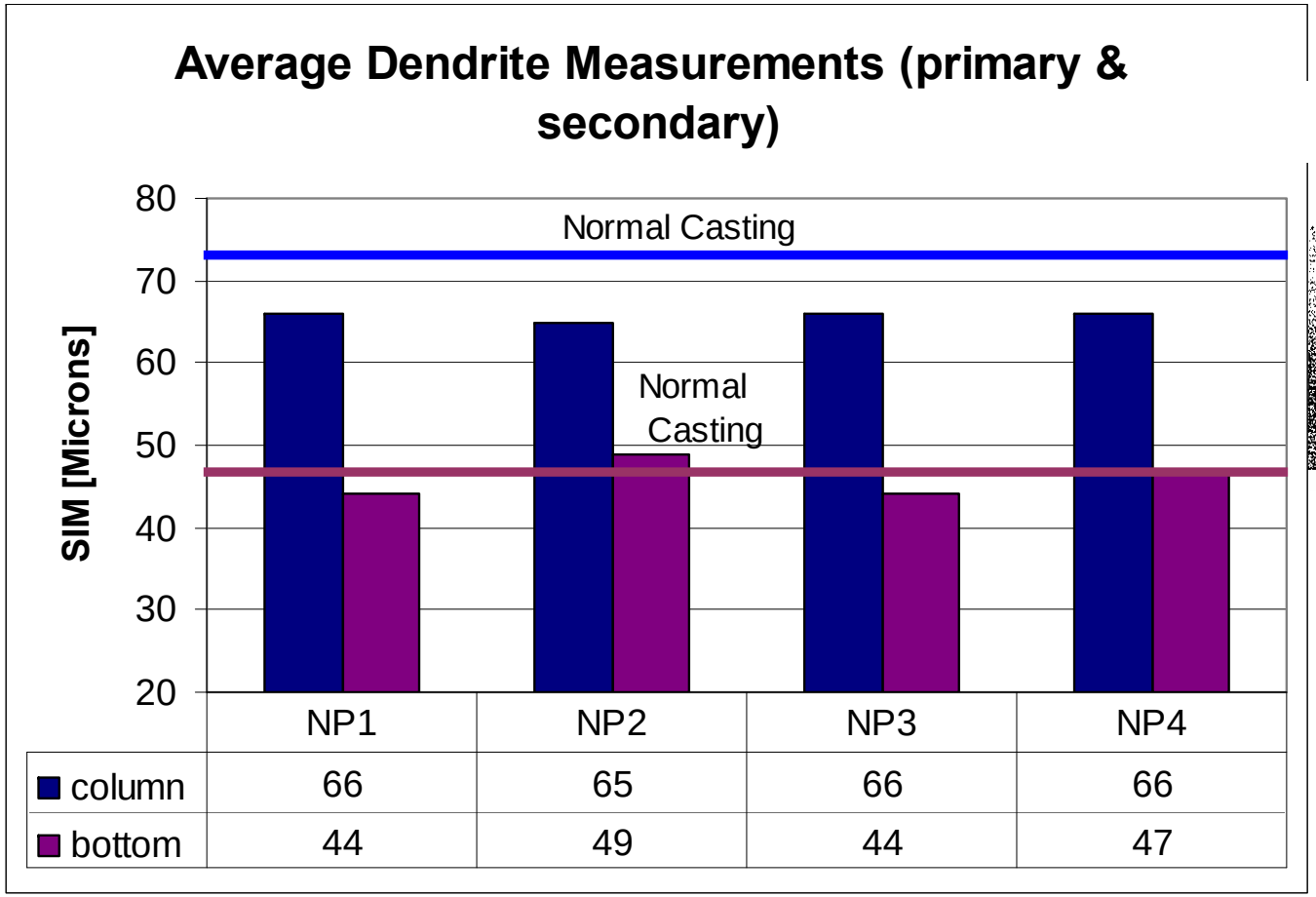
	Sy0.2-Cut 1	Sy0.2-Cut 2	Suts-Cut 1	Suts-Cut 2
NP casting	252.00	252.5	306.75	301.5
Normal casting	261	259	302	297

Elongation



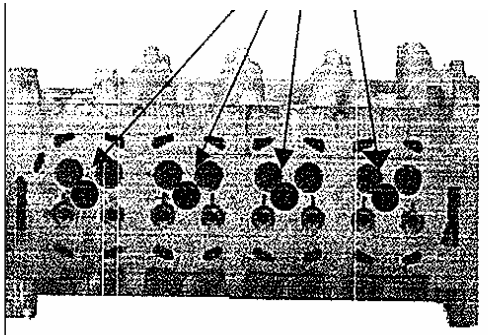
	Cut 1	Cut 2
NP casting	7.1225	4.78
Normal casting	2.91	2.34

Microstructure improvement

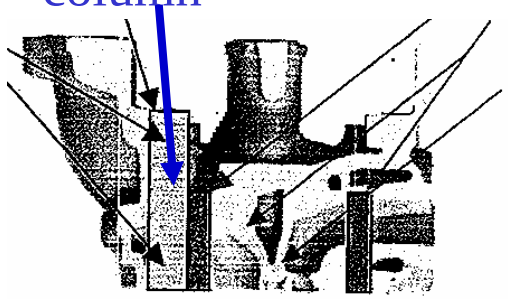


	NP1	NP2	NP3	NP4
column	66	65	66	66
bottom	44	49	44	47

Bottom of the casting



column



PTC Quality Improvements (Summary)

- Reduces porosity ratio by 80% at the top of the cylinder head, and 20% at the bottom of the cylinder head.

- Increases elongation by 200% at the top of the cylinder head, and 40% at the bottom of the cylinder head

Environmental Benefits to the Community

- **CO_2 Saving per cylinder head - 8.20kg**
- **Cylinder Heads produced in EU - 15,000,000 p.a.**
- **CO_2 Emission Saving in EU - 125,000 tons p.a.**

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Carbon allowances due to implementation of PTC process, calculated for a single Cylinder Head

Aluminium melting

Typical Specific Power Consumption	**0.6**	**kWh/kg of metal**
Metal spent in base case casting	**30**	**kg**
Metal spent PTC process	**20**	**kg**
Saved metal	**10**	**kg**
Saving of Electricity at terminal point	**6**	**kWh**

Sand core

Typical Specific Power Consumption	**0.4**	**kWh/kg of sand**
Top sand core used in base case casting	**20**	**kg**
Top sand core used in PTC process	**10**	**kg**
Saved sand	**10**	**kg**
Saving of Electricity at terminal point	**4**	**kWh**

CO_2 Saving : Power supplied from local grid

	For typical European country			
Assumed generation mix in the system	**% of total**	**Fuel LHV**	**Gross heat rate kJ/kWh**	**SFR**
Coal part	**60%**	**20,900**	**10,300**	**0.49**
Natural gas	**20%**	**35,400**	**8,000**	**0.23**
Nuclear	**20%**			
Hydro	**0%**			
Other Renewable	**0%**			
Total	**100%**	**NA**	**NA**	
Equivalent CO_2 emission factor	**0.74**	**kg CO2/kWh**		

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Reduction of Toxic Gas Emissions during casting and sand reclamation

Average commercial binder Kg/ton of cast Al alloy:

1. **Hydrocarbons → 8 kg/ton Al**
2. **VOC (Volatile Organic Compounds) → 11 kg/ton Al**
3. **HAP (Hazardous Air Pollutants) → 7 kg/ton Al**
4. **POM (Polycyclic Organic Matter) → 6 Kg/ton Al**

The PTC process can save 30% of the emission

Apart of direct economical savings,

the PTC process will:

Save 300,000 ton / year of melting aluminum in the EU

↓

Save 250,000 ton / year of CO_2 emission

&

Reduce employees exposure to chemical and toxic emissions

Thanks for your kind attention.

We are at your further disposal for further information. Ask us for descriptive leaflets or call:

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