

► SURFACE ROUGHNESS AND DIMENSIONAL TOLERANCE

Understanding the relationship between dimensional tolerance and permissible surface roughness may just help explain why a quote from the Machine Shop may be higher than expected. As John Baird, manager of the Machine Shop explains, it's all about "When you measure a dimension you know it will be accurate".

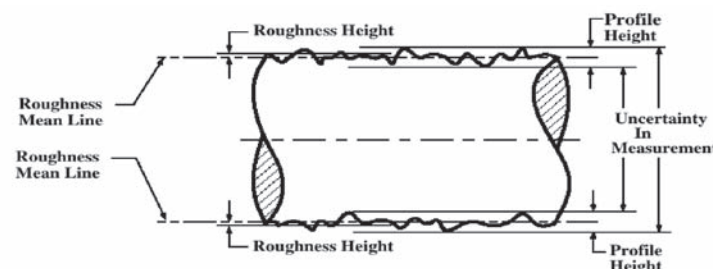
"A customer will supply us with specifications that state the surface finish only needs to be Ra 1.6µm (like a ploughed paddock), however the measurement is tied down to less than a 0.010mm tolerance. In order to have confidence when measuring the dimension specified accurately, we will quote to supply a better surface finish and achieve the drawing requirements. Unfortunately however, there is a cost element that will vary depending on the method used".

"Ultimately what happens is that the customer decides either the tolerance gets opened to accommodate the rougher finish, or accepts that the cost could be a little higher to achieve the tolerance by some finer finishing method or additional operation".

"As a rule, most general machining these days end up with a surface finish of Ra 0.8µm to Ra 1.6µm which is satisfactory to measure tolerances above 0.05mm".

"To accurately measure the 0.010mm tolerance, the surface finish really needs to be better than a Ra 0.8µm result, particularly with a shaft. This is due to the 'uncertainty in the measurement' at Ra 1.6µm getting close to 15% of the tolerance per side i.e. 30% for a shaft diameter".

The relationship can be explained like this:- Measurement of surface roughness involves the determination of the average linear deviation of the surface being measured and there is a direct relationship between the dimensional tolerance and the permissible surface roughness. For the accurate measurement of a dimension, the variations introduced by surface roughness should not exceed the dimensional tolerance. Otherwise, the measurement of the dimension will be subject to an uncertainty greater than the specified tolerance.



What we are conscious of, is that the roughness height (Roughness average "Ra") is typically only 25% to 35% of the profile height after all the smoothing and filtering that surface testers calculate. With issues like shaft fits, it may mean the difference of whether or not the design life is achieved.

The relationship between surface finish and, dimensional tolerance matters and does influence the final cost of the job.

Useful surface finish comparisons (Average)

AA	2	4	8	16	32	63	125	250	500
m Ra	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5
Grade	N2	N3	N4	N5	N6	N7	N8	N9	N10
Symbol									

If you have any queries in relation to this article please direct them to johnb@heat-treat.co.nz

MILLING

TURNING

DRILLING

BROACHING

REAMING

BURNISHING

GRINDING

HONING

POLISHING

LAPPING

Celsius

HEAT TREATMENTS LIMITED

A JUGGLING ACT

Issue 11 (Spring, 2006)

Operating a business can be a juggling act in more ways than one. With a tightening economy, energy supply uncertainties, and escalating input costs, managing the 'balls in the air' has become an even more demanding task.

At Heat Treatments the impact of all these factors has certainly been felt. The strength of the dollar has assisted us in offsetting some imported material cost increases and enabled us to renew plant from overseas, however the significant cost of payroll and energy have risen sharply.

The cost of energy has risen over 30% and as the majority of our process energy is electricity, with only a small part being natural gas, cost stability and security of supply is vital. Having had a wet winter it would seem that supply may be in good shape in the short term, however the recent interruptions of supply, certainly don't allow peace of mind.

In response to all these external factors we have continued investment in both plant (more efficient processes) and technology. This stance has served the company well in the past and has enabled us to provide our customers with significant price stability whilst also giving them the benefits of the improved technology. However it must be said that if costs continue to rise as they are we will have to review the sustainability of this approach and our ability to continue to contain price pressures in the medium-term.

At this point however we will continue to 'juggle the balls' as best we can and support our customers in doing the same.

In this issue we talk with a highly innovative company WhisperGen™ – who is making waves in the European energy market. Adam Walmsley gives us the low down on aluminium alloys and John Baird from the Machine Shop explains the relationship between cost, surface roughness and dimensional tolerances. We introduce a new member of the team Jamie Edwards and Steve Askew brings you recent system advancements, a quality update and a significant Health and Safety achievement.

Fergus Thomson
General Manager



116-118 Stoddard Road, Mt Roskill
PO Box 57025, Owhairaka, Auckland, New Zealand
Telephone: 09 621 0020, Facsimile: 09 621 0019
Website: www.heat-treat.co.nz

THE HEAT TREATMENTS SERVICE TEAM:

Heat Treatments:

Len Allen
Reece McGregor
Adam Walmsley

Customer Service
Production
Quotations

Technical / Metallurgical:

Machine Shop:

Adam Walmsley & Ivan Mitchell

Dennis Scotting
Brian Thompson
John Baird

Estimates & Quotations
Production
Operations

General:

Steve Askew
Kathy Williams
Elaine Folau

Quality Co-ordinator
Receptionist
Accounts Receivable



► KIWI INGENUITY STRIKES AGAIN



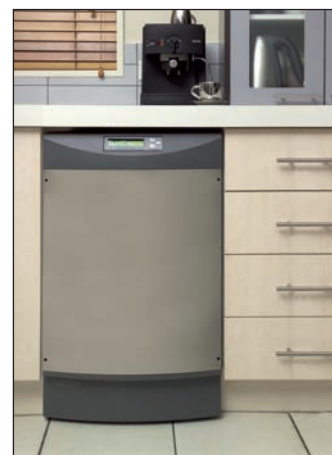
There are numerous businesses in New Zealand that have been built around 'Kiwi ingenuity' and WhisperGen Ltd is a prime example.

Based in Christchurch, the business evolved out of a PhD project initiated by Dr Don Clucas in 1989 involving the development of a commercially viable Stirling engine. With a successful prototype completed, Whisper Tech Ltd. was formed in 1995 to provide a vehicle for the on-going development, manufacture and distribution of AC Micro Combined Heat and Power (microCHP) and DC Marine / Power Systems. Whisper Tech Ltd. now holds the intellectual property which is exclusively licensed to the trading company WhisperGen Ltd.

Initially the company focused on developing the DC WhisperGen™ for the marine market. The quiet and efficient DC WhisperGen™ was an instant hit with yachties, who had been forced to depend on noisy, smelly and environmentally unfriendly diesel generators for their power.

By establishing their credentials in the marine market, WhisperGen™ was then able to push forward into the higher volume, lower margin consumer market with the AC WhisperGen™. Designed to replace gas-fired home boiler systems, this co-generation (heat and power) system

was developed primarily for the European market.



As small as a dishwasher, the AC WhisperGen™ is capable of heating and powering a house whilst also potentially producing excess electricity that can be returned to the grid. Utilising a range of different low cost fuels, the system has huge environmental benefits, primarily the reduction of CO₂ emissions e.g. a typical UK home can save 1-2 tonnes of CO₂ per year.

With the potential for massive environmental savings, various European governments and utility organisations have been keen to get alongside WhisperGen Ltd, and the company has already been commissioned by one UK utility company for 1,000 units, with a further commitment for up to 80,000 units over the next four years

Supported by two major shareholders, Meridian Energy and Orion New Zealand (formerly Southpower), WhisperGen Ltd. is bullish when it comes to the future. Manufacture of components is outsourced, leaving the company free to focus on R&D and the establishment of offshore markets. Massive growth within Europe has the potential to create the need to establish manufacturing facilities closer to the distribution point, however the company is determined to maintain its Christchurch base. With a purpose built facility and around 130 staff, the company are keen to ensure that 'Kiwi ingenuity' continues to drive all aspects of development and growth.

The company's involvement with Heat Treatments has centred around treating parts for various prototypes (specifically bearings) and the hardening and grinding of parts (con-rod pins / thrust washers) for the AC and DC WhisperGen's™.

According to Technical Director, Dr Don Clucas, a key reason for working with Heat Treatments is their willingness to help and the fact that they are recognised as leaders in their field.

"Heat Treatments has been happy to work with us on various prototypes and the assistance of their Lab and manufacturing teams has been invaluable. Unlike other organisations who are only focussed on 'big orders', Heat Treatments seem happy to work alongside smaller companies like ours, with the view to helping us grow," says Don.

For more information on WhisperGen™ visit www.whispergen.com



► THANKS FOR TAKING PART

A big thank you to everyone who responded to our recent survey. The information we received will enable us to refine *Celsius* and give you what you want. It was great to see companies being nominated for profiling and although there was support for an increase in the frequency of editions, it's unlikely the Editorial team would be up to the pressure of more deadlines!

The winner of the *Celsius* survey gift hamper was Russell Parnell from Mace Engineering – *Celsius* spoke with him to get some specific feedback on the magazine:-

"Thanks to Heat Treatments for the hamper - it was much appreciated. The *Celsius* newsletters are among the best we receive at Mace Engineering Ltd. They are well presented, informative and a welcome reminder of the services and technical support we receive in respect to the heat treatment of components we manufacture at Mace Engineering."

Russell Parnell - Sales & Marketing Manager

► HEAT TREATMENT OF ALUMINIUM ALLOYS

by Adam Walmsley

Heat treating, in its broadest sense, refers to any heating and cooling process that changes the mechanical properties or structure of a metal. When the term is applied to aluminium however, the phrase is usually referring to the strengthening-type heat treatments that apply to the precipitation hardenable or 'Heat Treatable' aluminium grades. Having said that, there are heat treatments such as annealing or stress relieving that apply to even the grades referred to as 'Un-Heat Treatable' alloys. In this article I will cover only the strengthening type treatments.

The common grades in use in New Zealand are as follows:

Heat Treatable Grades		Un-Heat Treatable Grades
2000 Series	} Extrusion grades {	1000 Series
6000 Series		5000 Series
7000 Series		
LM25	} Cast Grades	
CC601		
LM13		

Heat Treatment of the heat treatable grades is made up of one or a combination of treatments; solution treatment, natural aging or artificial aging (also known as precipitation).

An explanation of these processes is as follows:

Solution: This is a high temperature process; usually close to the alloys melting point, at around 500°C. After heating to the solution treatment temperature, the part must be quenched to trap all the alloying elements in what is called a 'solid solution'. Usually the quenchant is water or a polymer. The high temperatures and severe quenching involved usually means this process causes a large amount of distortion. Sometimes aluminium alloys are solution treated at the mill or extrusion plant by quenching as the aluminium exits the

tooling in order to control distortion. Immediately after quenching the metal is completely soft so there is an opportunity to straighten before aging occurs.

Natural aging: Natural aging involves leaving the material at room temperature for a period of time after solution treatment. Some of the dissolved alloying elements precipitate out of the solid solution and cause an increase in strength. This is a slow process as most alloys require about 96 hours to achieve full strength by natural aging.

Artificial aging: Also called precipitation hardening and usually following solution. A similar mechanism to natural aging but done at a slightly elevated temperature – commonly about 120°C - 200°C. The higher temperature accelerates the process significantly to typical aging times of 4 – 24 hours and usually results in a higher strength level than a naturally aged alloy.

The various combinations of the above processes when applied to an aluminium alloy are described by a 'temper' designation. This is usually expressed as a 'T' followed by a number, e.g. T6; T4.

Breakdowns of the Tempers are:

- T6 – Solution treated and artificially aged. Often the highest strength condition.
- T5 – Artificially aged only. Often used where risk of distortion from solution is too great. Generally not very high strength and with quite variable results.
- T4 – Solution heat treated and naturally aged. High strength but not as high as T6. Common with sheet materials so some formability is retained.
- T3 – Solution treated, and then cold worked and naturally aged. The cold work is usually a stretching or rolling operation at the mill and results in superior mechanical properties to T4 condition. Mostly used in the aviation industry.

► A WELCOME EXPERIENCE



When/where did you first become involved in heat treating?

I started out in 1990 with a company called Bodycote Heat Treatments in Rotherham, which is near Sheffield. My first role was as Quality Technician and then I moved onto Production Planning.

What qualifications do you hold?

I have a National Certificate in Metals and Materials which I received from the local technical institute in Rotherham.

What made you decide to come to New Zealand and join Heat Treatments?

We came out a couple of years ago on holiday

and I spent some time talking with various heat treating organisations. The chance to give my family a better lifestyle and work with an acknowledged leader within the industry was too good an opportunity to pass up.

What do you see as the major differences between heat treating here and in the UK?

With a larger number of facilities operating in the UK there is a lot more competition. There is a greater amount of large batch work with long term agreements signed between supplier and customer. In comparison the work here seems to be more on a 'jobbing' basis.

