

Thomas Dudley
Complete casting solutions

**THE ESSENTIAL GUIDE
TO CASTING PROCUREMENT**

WORLD CLASS DISAMATIC FOUNDRY EFFICIENCY OF 99.6% IS WELL ABOVE TYPICAL LEVELS

"The numbers are truly outstanding and we believe are also unprecedented. Efficiency of 99.6% is well above typical levels. It is impressive that your team has moved to a world class Disamatic foundry".

DISA Industries A/S 2014.



THOMAS DUDLEY PROVIDES A TRUE
SINGLE SOURCE SOLUTION FOR
CASTINGS IN GREY IRON, SG IRON,
AUSTEMPERED DUCTILE IRON AND
SiMo IN BATCH QUANTITIES FROM 100
TO 100,000 AND BEYOND.

COMPLETE CASTING SOLUTIONS

Thomas Dudley provides unrivalled casting solutions underpinned by exceptional service.

Our award-winning foundry division encompasses two engineering foundries located in the UK's West Midlands manufacturing heartland. Disamatic, Kunkel Wagner and airset moulding lines provide a uniquely flexible production platform that can produce quality assured components in batch quantities from 100 to 100,000 and beyond.

Our engineering capabilities include:

CASTING GRADES

- Grey iron grades BS EN 1561:2011
- SG / Ductile iron grades BS EN 1563:2011
- Austempered ductile irons (ADI) and SiMo

CASTING SIZES

- Disamatic mould sizes up to 750 x 570mm and castings to 20Kg
- Kunkel Wagner mould sizes up to 870 x 650mm and castings to 80Kg
- Airset mould sizes up to 1,400 x 1,400mm and castings to 120Kg

CASTING TOLERANCES

- Near net shape and within CT9 tolerances

CORE MAKING

- Full in-house Bianchi shell and Laempe cold box core making, coating and drying

FINISHING

- Precision drilling, tapping and grinding
- Painting, coating, enamelling and specialist finishes
- Assembly to integrate castings into sub-assemblies
- Bespoke packaging



FOR FURTHER DETAILS AND TO VIEW OUR VIDEOS, PLEASE VISIT WWW.THOMASDUDLEYCASTINGS.CO.UK



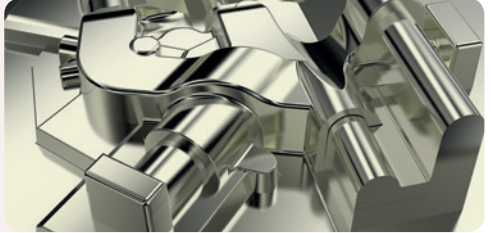
CONTENTS

6 THE CASTING PRODUCTION PROCESS

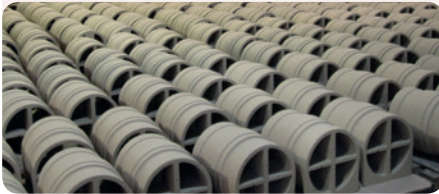


8 MATERIAL GRADES

10 PATTERNS



12 CORES



14 MANUFACTURING

16 PRODUCTION RELIABILITY



17 FINISHING



18 QUALITY



20 GLOSSARY OF TERMS

22 USEFUL SOURCES OF INFORMATION

23 AWARDS AND ENDORSEMENTS

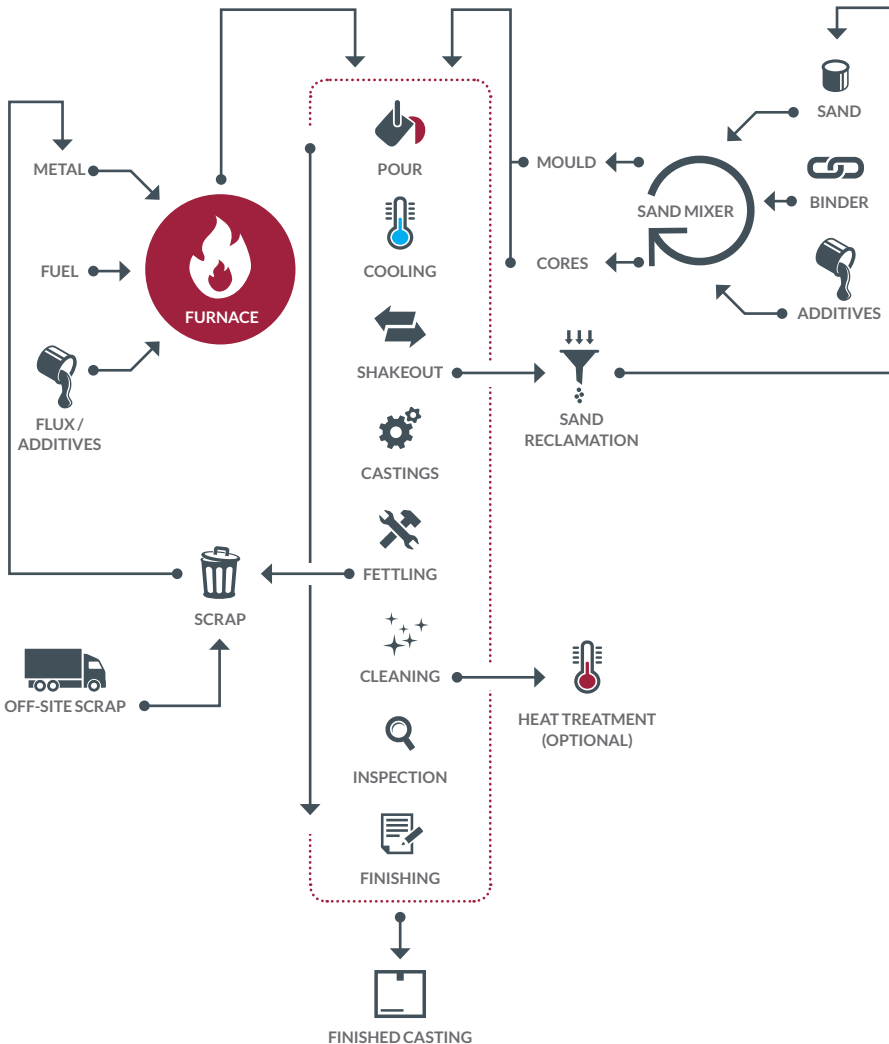
24 CONTACT DETAILS



THE CASTING PRODUCTION PROCESS

Although there are four main moulding methods (airset / chemically bonded, greensand, shell / croning and investment / lost wax), a number of common processes are involved in casting production.

As a professional purchasing castings, it is useful to have an understanding of these processes and the order in which they are undertaken.

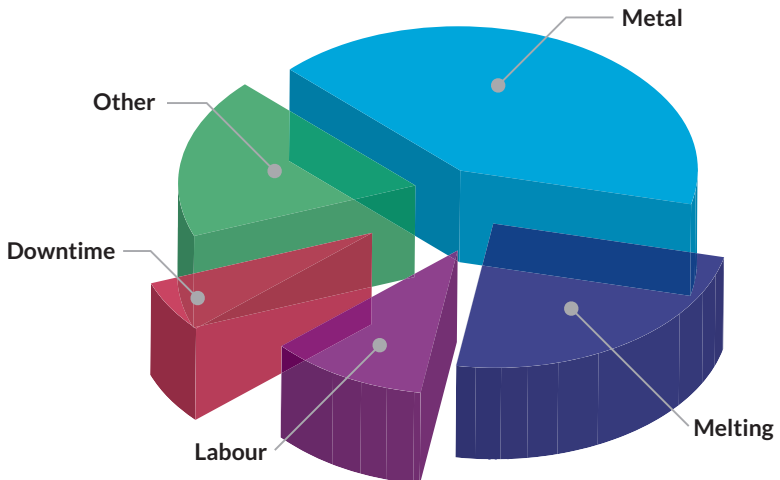


DISAMATIC VERTICAL SAND MOULDING

The Disamatic moulding process is fully automated and offers the advantage of not requiring flasks. The technology is widely acknowledged as providing the perfect production platform for medium to high volume iron castings and offers a cost-effective solution with:

- Exceptional reliability of 98%+ uptime
- Capacity to produce hundreds of quality assured moulds per hour
- High casting accuracy to minimise scrap
- High quality surface finish to near net shape to minimise dressing
- Low maintenance
- Full automation to reduce labour costs
- Reduced casting sand consumption

TYPICAL BREAKDOWN OF CASTING COSTS



MATERIAL GRADES

Iron castings can be produced in a wide range of grades. These provide different strengths and performance characteristics for a diverse range of applications. A selection of British standard grades which are widely adopted throughout Europe are detailed below.

For equivalent alternatives and other international grades, please refer to the Internet.

GREY IRON GRADES (BS EN 1561:2011):

Grey iron is the most commonly used material and is typically specified where the need for stiffness is more important than tensile strength.

GRADE	MIN TENSILE STRENGTH N/MM2	TYPICAL HARDNESS HB 10/300	EQUIVALENT: BS 1452: 1990 N/MM2	EQUIVALENT: BS 1452: 1961
EN-GJL-150	150	150-183	180	12
EN-GJL-200	200	159-194	220	14
EN-GJL-250	250	190-241	250	17
EN-GJL-300	300	200-280	300	20

DUCTILE IRON / SG IRON GRADES (BS EN 1563:2011):

Ductile or SG iron is more impact and fatigue resistant than grey iron and is used in applications that require harder wearing castings.

GRADE	MIN TENSILE STRENGTH N/MM2	0.2% PROOF STRESS N/MM2	ELONGATION (%)	TYPICAL HARDNESS HB	EQUIVALENT: BS 2789: 1985
EN-GJS-400-18 RT	400	250	18	<175	400/18
EN-GJS-400-15	400	250	15	<180	
EN-GJS-450-10	450	310	10	<212	420/12
EN-GJS-500-7	500	320	7	170-241	500/7
EN-GJS-600-3	600	370	3	192-269	600/3
EN-GJS-700-2	700	420	2	229-302	700/2

AUSTEMPERED DUCTILE IRON (ADI) GRADES (EN 1564:2011):

Austempered ductile irons have been heat treated to improve their strength and durability. These castings offer performance characteristics that are similar to those of steel but at a much lower cost.

GRADE	MIN TENSILE STRENGTH N/MM2	0.2% PROOF STRESS N/MM2 (MIN)	MIN ELONGATION (%)
EN-GJS-800-8	800	500	8
EN-GJS-1000-5	1000	700	5
EN-GJS-1200-2	1200	850	2
EN-GJS-1400-1	1400	1100	1

SIMO HIGH TEMPERATURE IRON GRADES:

SiMo is ductile iron that has been enhanced with silicon and molybdenum. This increases high temperature performance and makes the material ideal for use in applications such as exhaust manifolds and turbocharger housings.

TEMPERATURE	TENSILE STRENGTH N/MM2	0.2% PROOF STRESS N/MM2	ELASTICITY N/M X 104	TYPICAL HARDNESS BHN
23	550	480	14.8	200-240
300	480	395	14	
500	350	270	12	
800	50	30	2.5	

PATTERNS

Foundry patterns can be made in a number of different materials. It is essential to choose the correct material for the given required accuracy and production volumes.

POLYSTYRENE PATTERNS:

- Disposable patterns for one-off use
- The lowest cost option
- Offer flexibility in design

WOOD PATTERNS:

- For low accuracy, low volume production
- Suitable for production of 10's to 100's of castings
- Storage needs to be controlled to avoid pattern swelling

PLASTIC PATTERNS:

- For higher quality castings than wood patterns
- Suitable for production of up to a few thousand castings
- Unlike wood, plastic patterns are non-hygroscopic so will not absorb water

ALUMINIUM PATTERNS:

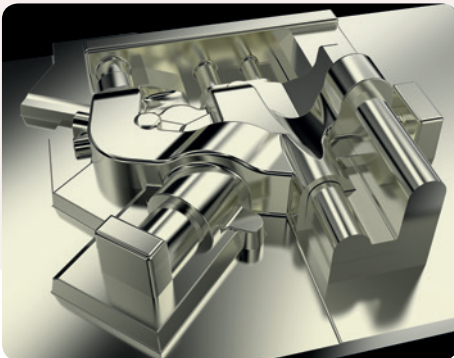
- For high accuracy castings
- Suitable for production of 80,000 – 100,000 castings
- Can be cast and machined

IRON / PLATED PATTERNS:

- Made in iron or steel with optional hardened coating
- For high accuracy castings
- Suitable for producing up to 500,000 castings when re-plated

PATTERN COSTS:

Pattern costs vary by material with polystyrene the least expensive followed by wood, plastic and then aluminium. Iron/plated patterns are the most expensive. The choice of material is really a balance between cost and casting requirements.



KEY POINTS:

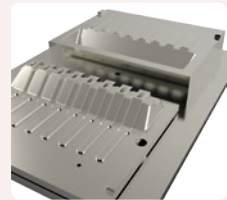
Make sure the foundry has the capability to engineer patterns from whatever you can provide. This can range from stage drawings, existing patterns and sample castings to 3D CAD files.

To avoid future conflict, it is essential to clearly establish whether you or the foundry owns patterns, tooling, methods and running systems, mounting plates and ejection systems.

At the time of placing an order, expect the foundry to provide:

- A full description of the tooling including number of impressions
- The material the pattern is made from
- Projected pattern life
- Responsibility for pattern maintenance
- Confirmation of the insurance covering patterns that are in the foundry's possession against loss and damage
- Concessions in manufacture compared with the supplied drawings

It should also be made absolutely clear and agreed in advance whether sample castings must conform with drawings, 3D models or any interim revisions.



Question the foundry on their expertise in NPI project management and ensure that they are experienced in working with customers to develop new castings.

CORES

Cores essentially enable an internal hollow or cavity to be moulded into a casting. A core is a sand shape that is laid into the mould so that sand can be laid around it to produce the mould.

HEAT CURED CORE MAKING (SHELL OR HOT BOX):

- Ideal for high volume manufacture of small to medium sized cores
- Requires metal tooling as cooling takes place at 300°C
- Tooling is relatively expensive
- Generates smooth surfaced cores with little additional coating
- Typically used for cores that need to be made in sections of 6mm or less
- An automated process

CHEMICALLY CURED CORE MAKING (COLD BOX):

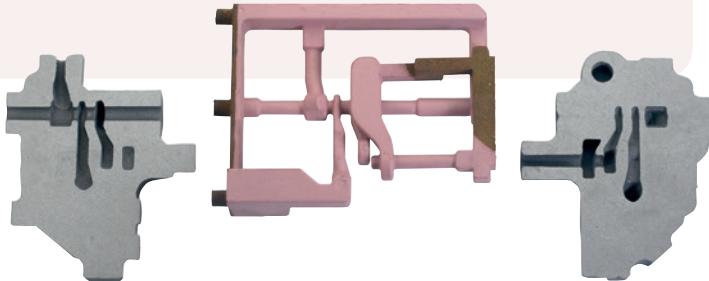
- Used for larger cores with a virtually unlimited size
- Compatible with low cost tooling materials such as wood and resin
- Core sections are generally above 6mm
- Additional surface coating is required
- Can be a manual or automated process

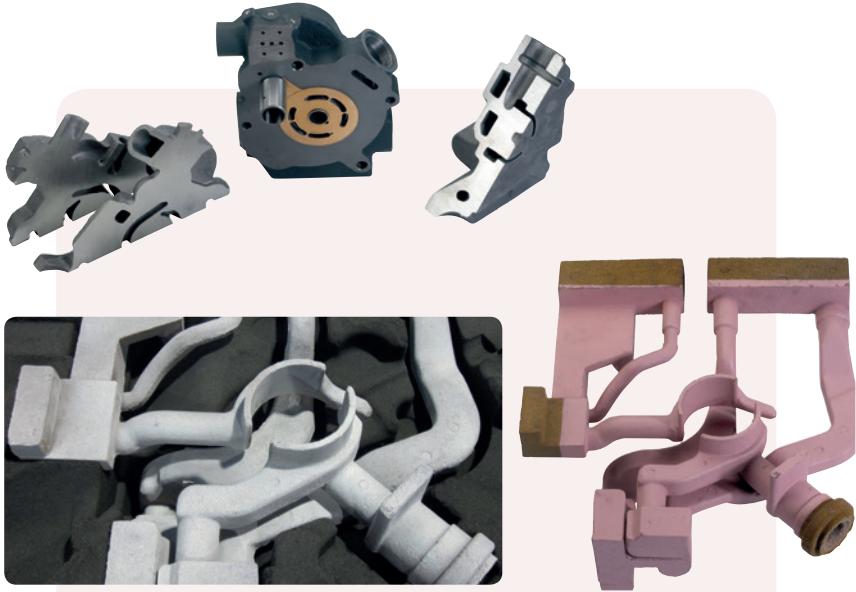
KEY POINTS:

It is essential to specify any surface finish or chemical cleaning requirements.

If a high degree of internal cleanliness is needed, it should be clearly established whether the foundry has expertise in and an understanding of core coating and drying, low expansion moulding materials and cleaning of castings to clinical standards.

Quotations should include any required post production preparation such as chemical cleaning and spot blasting.





MANUFACTURING

There are four commonly used moulding processes employed by foundries to manufacture castings and it is important to select the correct one for each individual project.

AIRSET / CHEMICALLY BONDED MOULDING:

- Labour intensive
- Almost no limit on maximum casting size which can reach several hundred tonnes
- For one-off, low volume and prototype production
- Typically manufactures castings to CT 10/12 tolerances

GREENSAND MOULDING:

- Produces casting integrity and surface finish that are of a high enough quality for most applications
- Generally offers the most cost-effective production for medium to high volume batches
- Includes horizontal and vertical moulding
- Horizontal moulding uses flasks, is a hungry consumer of spares and can typically produce up to 120 moulds per hour
- Disamatic vertical moulding lines do not require flasks, have cores set by masks rather than by hand and can produce hundreds of moulds per hour
- Typically manufactures castings to CT 8/9 tolerances

SHELL / CRONING MOULDING:

- Ideal for the production of highly intricate castings
- Provides a cost-effective alternative to investment / lost wax casting for detailed components
- Typically manufactures castings to CT 7/8 tolerances

INVESTMENT / LOST WAX MOULDING:

- Involves a high number of processes and is the most expensive production method
- Not confined to conventional casting geometry
- Can cast intricate shapes but is only really used where there is no alternative option
- Typically manufactures castings to CT 5/6 tolerances

The choice of manufacturing process should be determined by casting size, complexity, surface finish, cost and tolerance.

Casting tolerance or CT grades are detailed in the table below:

CASTING SIZE MM (UP TO AND INCL)	CASTING TOLERANCE MM																
					INVESTMENT /LOST WAX MOULDING		SHELL / CRONING MOULDING		GREENSAND /DISAMATIC MOULDING		AIRSET / CHEMICALLY BONDED MOULDING						
	CT1	CT2	CT3	CT4	CT5	CT6	CT7	CT8	CT8	CT9	CT10	CT11	CT12	CT13	CT14	CT15	CT16
10	0.09	0.13	0.18	0.26	0.36	0.52	0.74	1	1	2	2	2.8	4.2				
10-16	0.10	0.14	0.20	0.28	0.38	0.54	0.78	1.1	1.1	1.6	2.2	3	4.4				
16-25	0.11	0.15	0.22	0.3	0.42	0.58	0.82	1.2	1.2	1.7	2.4	3.2	4.6	6	8	10	12
25-40	0.12	0.17	0.24	0.32	0.46	0.64	0.9	1.3	1.3	1.8	2.6	3.6	5	7	9	11	14
40-63	0.13	0.18	0.26	0.36	0.50	0.70	1	1.4	1.4	2	2.8	4	5.6	8	10	12	16
63-100	0.14	0.20	0.28	0.40	0.56	0.78	1.1	1.6	1.6	2.2	3.2	4.4	6	9	11	14	18
100-160	0.15	0.22	0.30	0.44	0.62	0.88	1.2	1.8	1.8	2.5	3.6	5	7	10	12	16	20
160-250		0.24	0.34	0.50	0.70	1	1.4	2	2	2.8	4	5.6	8	11	14	18	22
250-400			0.40	0.56	0.78	1.1	1.6	2.2	2.2	3.2	4.4	6.2	9	12	16	20	25
400-630				0.64	0.90	1.2	1.8	2.6	2.6	3.6	5	7	10	14	18	22	28
630-1000					1	1.4	2	2.8	2.8	4	6	8	11	16	20	25	32
1000-1600						1.6	2.2	3.2	3.2	4.6	7	9	13	18	23	29	37
1600-2500							2.6	3.8	3.8	5.4	8	10	15	21	26	33	42
2500-4000								4	4	6.2	9	12	17	24	30	38	49
4000-6300										7	10	14	20	28	35	44	56
6300 - 10000											11	16	23	32	40	50	64

PRODUCTION RELIABILITY

Production reliability should be a key factor in the decision to work with any new foundry. You need to be certain that the foundry has the processes in place to maintain excellent reliability to minimise the potential for your own output to be affected if castings cannot be delivered on time.

ASK FOR EVIDENCE OF THE FOLLOWING BEING IN PLACE OR IN DEVELOPMENT:

- Computerised Maintenance Management System (CMMS)
- Asset Strategy Development Programme (ASD)
- Design for Manufacture (DFM) feasibility exercises
- Process Failure Modes and Effects Analysis (PFMEA) risk management
- In-house laboratory testing
- In-house Non-Destructive Testing (NDT)
- Advanced Product Quality Planning (APQP)
- Production Part Approval Process (PPAP)



FINISHING

A WIDE RANGE OF FINISHING SERVICES ARE AVAILABLE INCLUDING:

- Grinding, drilling, tapping and machining
- Shot blasting
- Chemical cleaning
- Heat treatments
- Etching and date stamping for traceability
- Painting, coating, enamelling, galvanising, zinc plating, cadmium plating, sulphuric anodising and other specialist surface finishes
- Assembly and packing

KEY POINTS:

Whilst casting finishing can be sourced separately, it is usually beneficial to source as much of this as possible from the foundry.

Placing finishing operations with the foundry that manufactures base castings can significantly reduce transport costs, wastage and processing timescales. Further economies can also be realised. If for example, a foundry is making and machining castings, the need to undertake pre-machining de-flashing can often be eliminated.



QUALITY

When considering whether a foundry can provide a quality assured source of supply, the following should be offered as a matter of course:

- BS EN ISO 9001 (Quality Management Systems)
- BS EN ISO 14001 (Environmental Management Systems)
- OH SAS 18001 (Health & Safety Management Systems)

It is worth asking about a foundry's Occupational, Safety Management, Health and Environmental policies and employment of methodologies including lean manufacturing, Six Sigma, TQM, APQP and PPAP.

Technologies such as ATAS (Adaptive Thermal Analysis System) and 3D scanning can also help to underpin quality control.



KEY POINTS:

If a foundry is open about quality management, they should welcome the opportunity to provide case studies and customer referrals.

It is important to have a clear understanding of the limits of liability in the agreed terms and conditions of engagement.

Also make sure that the foundry has adequate public liability insurance to safeguard against potential in-situ casting failure.



Cert. No. FM0614



Cert. No. EMS72025



Cert. No. OHS89327



GLOSSARY OF TERMS

3D SCANNING

Advanced technology that can be used to produce model files of existing castings or check the conformity of finished casting to the required specification.

AIRSET MOULDING

Manual, labour intensive process that can be used to produce prototype, one off and very small batch castings.

ALLOYS

Materials with improved performance that are produced by combining multiple metals together or one or more metals with a non-metallic substance.

ATAS

Adaptive Thermal Analysis System that is used to accurately match iron formulations to the required specification. Can store thousands of recipes which can be called off as and when needed.

AUSTEMPERED DUCTILE IRON (ADI)

Ductile iron that is heat treated to provide a strength and durability that is comparable with steel but at a fraction of the cost.

CASTING TOLERANCE

A pre-agreed range that defines the dimensional tolerances of acceptable finished castings.

CORE

A sand stick that is inserted into the mould to form an internal cavity in the casting.

CORE COATING

The application of a special coating to the outside of a core to optimize casting cavity integrity and surface finish.

DISAMATIC MOULDING

Greensand lines that blow sand into a chamber before compressing it via patterns at either end of the chamber. Recognised as the market-leading technology for high volume, high accuracy casting.

DRAFT / TAPER

The angle needed for a pattern to be removed from the sand mould whilst leaving the mould in tact.

DUCTILE IRON / SG IRON

Grey iron that is treated to force the graphite to form nodules rather than flakes. This provides improved durability, strength and wear resistance.

FERROUS ALLOYS

Alloys that have iron as their main component.

GREENSAND MOULDING

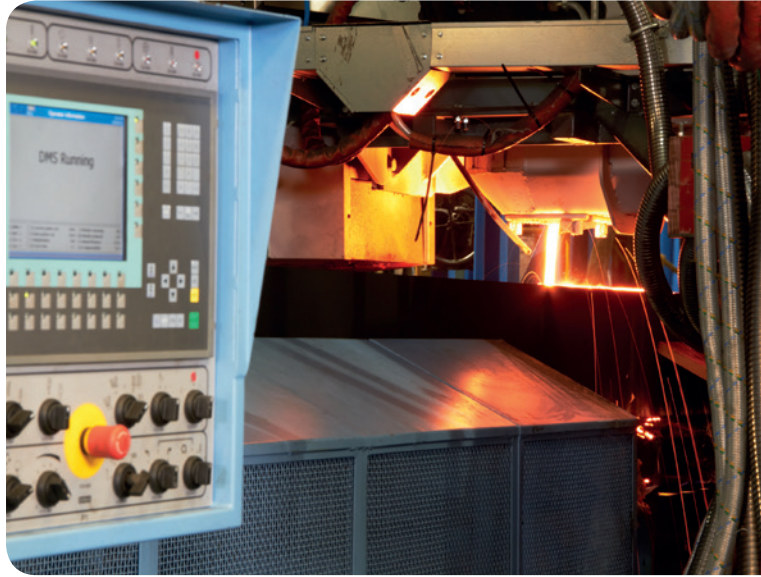
Commonly used moulding method that produces castings of a high quality. Horizontal and vertical moulding is typically used to cost-effectively produce castings to CT 8/9 tolerances.

GREY IRON

An iron:carbon alloy that is the most commonly iron casting material. Suitable for a very broad range of applications, grey iron offers excellent castability and machinability.

INVESTMENT / LOST WAX MOULDING

Process intensive and costly method that can cast intricate shapes that are beyond other moulding techniques.



MACHINING ALLOWANCE

Refers to castings made larger than dimensionally required to accommodate material that will be removed during machining.

NON-FERROUS ALLOYS

Alloys that incorporate non-iron metallic materials.

PARTING LINE

Formed when the casting and parting surfaces of the mould meet.

PATTERNS

Used to mould the sand into the required shape in order to produce a casting. Can be made from a variety of materials depending on required casting accuracy and volumes.

SHELL / CRONING MOULDING

A cost-effective alternative to investment casting that is used for highly intricate components.

SIMO

Ductile iron enhanced with silicon and molybdenum to provide excellent high temperature performance.

USEFUL SOURCES OF INFORMATION

CAST METALS FEDERATION

National Metalforming Centre

47 Birmingham New Road

West Bromwich

West Midlands B70 6PY

Tel: +44 (0)121 601 6397

Web: www.castmetalsfederation.com

INSTITUTE OF CAST METALS ENGINEERS

47 Birmingham Road

West Bromwich

West Midlands

B70 6PY

Tel: +44 (0)121 601 6979

Web: www.icme.org.uk

FOUNDRY TRADE JOURNAL, CASTINGS BUYER MAGAZINE AND CASTING BUYER'S DIRECTORY

Winton House

Lyonshall

Herefordshire

HR5 3JP

Tel: +44 (0) 1544 340332

Web: www.foundrytradejournal.com

AWARDS AND ENDORSEMENTS

Thomas Dudley is a multi-award winning organisation. In 2013, we were named Business of the Year by the Black Country Chamber of Commerce and received the Cast Metals Federation's Company Achievement Award in 2014.

In addition, testimonials from a small selection of our customers are provided below.

“

Although we needed to find a new less labour intensive method of production, it was essential to retain the original characteristics. Thomas Dudley understood this and identified a design that could be easily moulded out of cast iron. We are delighted with the results of the project which has helped us keep pace with growing demand.

Hotpod LLP



We fully appreciate the response and energy that Thomas Dudley has put into satisfying our production requirements which in turn has enabled us to satisfy customer schedules. We look forward to a continued and growing relationship that will benefit both companies.

Dynamatic Hydraulics

When we needed to source bespoke cast iron railing stanchions for a major new build contract, Thomas Dudley provided the perfect solution. They worked with us to complete the project in eight weeks and the service they provided throughout was exceptional.

Pudsey Diamond Engineering Limited



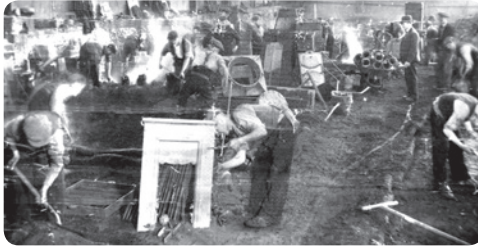
We are three quarters through machining the latest batch of castings and we haven't had a single reject. You have managed to do what no one else has which is excellent news.

Falcon Engineering and NV Tools

”

UNRIVALLED QUALITY EXCEPTIONAL SERVICE

Thomas Dudley is committed to providing unrivalled casting solutions underpinned by exceptional service. We are proud to remain a family owned business that is driven by the same values as when we started our business in 1920. As a result, we are able to forge long term relationships with each and every customer.



ENQUIRIES

Please call **0121 530 7000** or email **foundrysales@thomasdudley.co.uk**



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