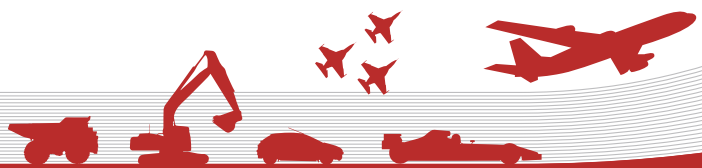
BONEHAM®

Precision Engineered Solutions

www.boneham.co.uk

/ Tel: +44 (0)1623 445 450
/ Fax: +44 (0)1623 445 451
/ sales@boneham.co.uk

NEXT DAY DELIVERY ON STOCK ITEMS
348 PRODUCTS INSIDE



www.koenigexpander.co.uk / www.shimpress.co.uk

SFC-KOENIG EXPANDER® SHIMPRESS DADCO

BONEHAM®

Celebrating 100 YEARS 1918 – 2018

1920 1924 1926

1918

JOHN BONEHAM

John Boneham was born on the 21st April 1885. In 1899 he gained an apprenticeship as a toolmaker with Barringer, Wallis & Manners Ltd.

In 1906 he took up a position in India with North West Box Manufacturing Company of Calcutta.

1909 John took up a position to install a manufacturing facility making pencil tins. After not being paid for his work, an argument progressed into John being severely beaten. Having escaped the hospital during guard exchange, John fled to Rangoon where he was hired by Mower Ltd. managing Agent gold on the Irrawaddy river.

After losing everything due to the Rangoon bank collapse, John returned to the UK eventually working for Peter Brotherhood manufacturing munitions during WW1.

1918 On 23rd August, 1918, Boneham and Turner Ltd was founded by John Boneham and Mr Turner. Most great enterprises have humble beginnings; Boneham and Turners commenced with the making of Jigs, Fixtures and Press Tools in a farm previously renowned for cock-fighting, then named "Cockpit Close" but altered to what we know as Duke Street.

ABOVE: The Duke Street works.

LEFT: The company's Certificate of Incorporation dated 23rd August 1918.

1920s

WHAT BEGAN as a location where locals used to gamble on their prized cockerels, became too much of a gamble for Mr Turner during the nationwide slump of the early 20's. Not only did John buy Mr Turner out, but he also hedged on two large investments from the US: The first a Landis Crankshaft Grinder, and the second a Heald Planetary Grinder.

Throughout the 1920's and 30's the company not only produced many thousands of reconditioned engines, but also manufactured most of the components of the E.R.A racing engines.

1920 The first patent granted to Boneham and Turner Ltd was in 1920 for improvements in the manufacture of dimpled golf balls.

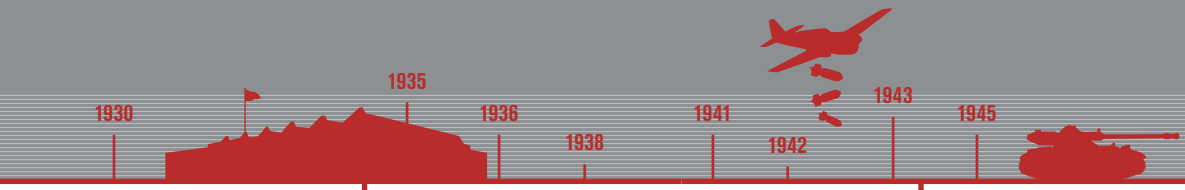
1924-26 It was during 1924 that Boneham and Turner manufactured vertical hones to create, what would become to be known as, the cross-hatched finish. This developed the oil retaining properties required in the cylinder bores of motor engines. By 1926 five vertical hones had been manufactured.

It was during this time that Boneham also manufactured the American ACCO range of paper fasteners. A product that was manufactured by the company up until the 1960's.

TOP: The Duke Street works from 1918 through the 1920's featured belt driven machines.

ABOVE LEFT: The first patent granted to Boneham and Turner Ltd was in 1920 for improvements in the manufacture of dimpled golf balls. Three variants which shaped the golf ball we know now.

ABOVE RIGHT: Reconditioned engines from the 1920's.



1930s

ABOVE: Boneham and Turner, Nottingham Road works, 1936.

1930 William Boneham, second son of John Boneham joined the company in 1930. William added scientific and mechanical flair to the organisation.

1935 The company grew at a fast rate during the 1930's under the stewardship of John and William. It was after 1935 when the country began to re-arm that Boneham and Turner won significant contracts.

1936 It was during 1936 that Boneham and Turner Ltd looked to the US to help influence the standardisation of drill bushes in the UK. The company launched the first standard drill bush range in the UK.

The Nottingham Road factory, which was Boneham and Turners headquarters for 72 years, began construction in 1936. The factory was developed over the years with additions such as a second storey.

1938 Peter Boneham joined the company in 1938 from Sheffield University as a trainee toolmaker.

Reg Parnell and Raymond Mays were the pre-eminent British racing drivers of the 1920's and 30's competing in the equivalent of Formula One today. Regular visits from both drivers during the early 30's were common place. Peter Boneham received driving lessons off Raymond Mays at the age of 17.

ABOVE LEFT: Tail plane uprights for the Lancaster Bomber at Croft Mill.

ABOVE RIGHT: Hoisting the Union Jack at the Nottingham Road works on V.E. Day 1945.

LEFT: Letter for John Boneham's OBE.

1940s

WWII The early war years saw the shift from motorsport and automotive, with its inevitable decline during this time, to orders received to support the war effort. There was a substantial order book, with Rolls Royce, Bristol Aircraft and De Havilland being projects of note.

War demand necessitated the extension of the Nottingham Road site to 53,000 sq. ft and the acquisition of the Croft Mill site on Bottle Lane. Machines at this time were Dean, Smith and Grace, Lang, and Holbrook lathes. Archdale, Cincinnati, Milwaukee, and Parkson milling machines. Bryant, Jung, Heald, Keighley, Jones and Shipman, Churchill and Precimax grinding machines. The company in the early 1940's employed over 400 people spread across three sites.

During the war Boneham and Turner Aircraft manufactured engine parts for the Rolls Royce Merlin engines destined for the Supermarine Spitfire. The company was also producing fuselage component parts such as the Plexiglass cockpits for the Spitfire, Lancaster and Wellington planes. The Croft Mill works also manufactured the uprights for the tail planes of the Lancaster Bomber.

1941 The company took delivery of a Mattison Surface Grinder. The substantial shipping crate for this immense, American machine was packed with tins of food from the US, a generous offering after rationing had begun in the UK from January 1940. This was the beginning of Boneham's 'special relationship' with the US, which continues to be a significant part of the business today.

ABOVE: Mattison Surface Grinder arriving in 1941, along with a copy of the original receipt.

1942 Boneham and Turner's standardised drill bush range formed the backbone of the British Standard for drill bushes in 1942 by the Standards Committee.

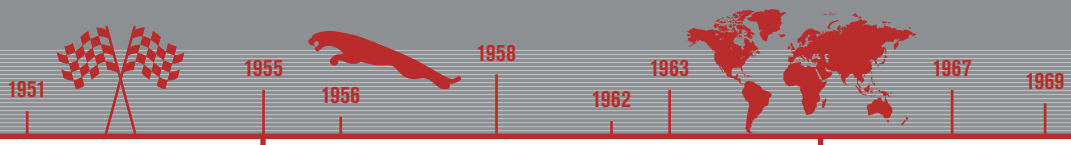
1943 It was in 1943 at the Kings Birthday Honours, George VI appointed John Boneham to the Order of the British Empire (OBE).

During this time the company manufactured many of its own specialist machines. Two of the bench lathes remain in use today. One of the operators Mrs. Mary Lee, was recognised with a British Empire Medal for her work on these machines through the war, working 12 hours a day.

1945 May 8th 1945. Victory in Europe Day. The US and Union Jack flags were hoisted and flown above the Nottingham Road works.

As wartime contracts came to an end, the company's standard parts catalogue grew. Peacetime demand was high and production was booming on all fronts. The company was manufacturing electrical laminations, toggle clamps, spindles, fine boring machines, die sets, drill bushes and fixturing parts. There was also the revival of work with E.R.A and Raymond Mays.

www.boneham.co.uk / Tel: +44 (0) 1623 445 450 / Fax: +44 (0) 1623 445 451 / sales@boneham.co.uk



1950s

1951 Manufacturing for E.R.M again led to the Mays Project which became the B.R.M 16 cylinder racing car. Raymond Mays founded British Racing Motors in 1945, with the first championship race in 1951 at the British Grand Prix. The hemispherical combustion chambers were manufactured on the S.I.P Jig borer

Nottingham Road in the early 1950's had a full order book. With deliveries on fine boring machines out to 12-14 months. Spindles were out to around 16 to 20 weeks. A Societe Genevoise S.I.P Jig Borer was purchased around this time, which was the biggest investment to date, the equivalent of £330,000 today.

In 1951 the factory at Field Mill was built. Under the management of Peter Boneham, the site had a great team of toolmakers. It was a highly productive factory with sales of £16m in todays money from 40 people. Presses from C.V.A and Bliss were part of the capacity, as well as, Newall jig borers and Studer grinders.

The principle of the hemispherical combustion chamber was also used in a design by Jaguar and used on the XK 120 and Mark 7 saloon. Boneham and Turner designed and built a special purpose boring machine for this operation. The machine ran through the manufacturing lifetime of those models.

1955 Founder John Boneham O.B.E died December 1955 aged 70. A clear end of an era and one that would remove a balance in the organisation resulting in uncertainty for the next decade.

1956 John W Boneham joined the company in 1956. The 1950's was a fantastic trading period for the company. Although held back by death duties and sale of 24% of the company to I.C.F.C to pay them. John recalls the fantastic array of machinery and skills available to the company. All were highly receptive to training the next generation.

The involvement with B.R.M and Jaguar carried on. The principle first designed by William Boneham of scratch-line elimination, was used by Jaguar and Dunlop in the development of disk brakes, first used in the braking systems for the Type C and D Jaguars. Boneham fine boring machines were extremely popular at this time with a constant order book of over 18 machines.

1958 Dowel pins and shims were also major products at this time. High volume items that created better cash flow for the company, when deliveries and costs associated with the fine boring machines were high. By 1958 the order book for spindles was 600 strong and 80 spindles a month being dispatched.

Ferranti had approached Boneham and Turner Ltd to achieve accuracy of less than -0.0001" total run-out for a memory drum for the Atlas computer. This was achieved and the company went on to manufacture drums for the Pegasus, the hard drive of the era.

LEFT: B&T Precision News cover showing B.R.M. Racing Car cylinder head.

The Boneham and Turner boring machine used to build the Jaguar XK 120 hemispherical combustion chamber.

1960s

1962 William Boneham passed away 28th December 1962 aged 48. J.W Boneham became a Director.

1963 January 1963, longest serving colleague, Mick Northing started with Boneham and Turner. Still leading the shim section of the business after 56 years.

1967 The company undertook their first exhibition in the US. Standing at Chicago Machine Tool Exhibition with spindle and drill bushings the main display. The spindles sold out and Engis Equipment became the US agent for spindles.

The company was thriving in the mid 1960's. With Field Mill and Nottingham Road processing 700 transactions a day on standard parts.

1969 Boneham and Turner Ltd had 16 agents across the globe including, Japan, Africa, Australia, USA, Canada and throughout Europe.


Firm that serves the world is 50 years old

LEFT: Boneham and Turner's longest serving colleague Mick Northing.

Mansfield Chad article celebrating Boneham and Turner's 50th Anniversary in 1968.

LEFT: Boneham and Turner at the 1967 Chicago Machine Tool Exhibition.

BELOW: Field Mill and an aerial view of Nottingham Road in 1937.

www.boneham.co.uk / Tel: +44 (0) 1623 445 450 / Fax: +44 (0) 1623 445 451 / sales@boneham.co.uk

1970s

ABOVE: The company received its largest ever order from Asquith in 1975, an order worth over £500,000 (£4.9m today) for fine boring machines.

ABOVE: Margaret Thatcher and her husband Dennis visiting Boneham and Turner in 1975, along with a thank you letter she sent after her visit.

1970 Boneham and Turner was growing rapidly. Both sites were extended heavily. Many new machine purchases were made, with new NC controls. All facets of the company were pushing forward.

The company was taking on 9 apprenticeships a year in the late 1960's and 1970. The 1970's however became an incredibly turbulent decade. Industrial action in industry and the Post Office would significantly damage sales.

Despite the competitive and challenging environment, Boneham and Turner continued into product development and always kept quality at the forefront, whilst others reduced costs by diminishing quality.

1972 The company completed the acquisition of Brico Metal Products Inc. Brico Metal Products was a joint venture between BAC and Hitchiner Corp. The venture didn't work out for both parties. In October 1972 it became Boneham Metal Products Inc. This would be an extremely important acquisition for the future of the company.

1974 Boneham Metal Products ran successful testing with General Motors in Detroit. The longevity of the Nitralloy bushings meant GM saved 60% on the Trenton Engine project. This would go on to be one of the company's largest customers for many years until transfer lines were removed.

1975 Nicholas Boneham joined Boneham and Turner moving out to Castleisland in 1975 to open up a factory to support the manufacture of 4 million dowel pins a year.

The company received its largest ever order from Asquith, an order worth over £500,000 (£4.9m today) for fine boring machines.

On 2nd May 1975, Margaret Thatcher and her husband Dennis made an official visit to Boneham and Turner. She was particularly interested in family run manufacturing companies. They showed a great deal of interest in the production and staff.

1976 Boneham and Turner Technical Director Ken Doy was awarded the MBE in the Queens honours at Buckingham Palace on the 14th May 1976.

In the summer of 1976 Boneham and Turner took over British Aero Components Ltd (BAC). This would add the nitralloy range of bushings as well as a significant amount of business in the UK. The acquisition included the Koenig Expander Plug agency. The Koenig Expander Plug would go on to be one of the companies most important product lines.

LEFT: Boneham and Turner Technical Director Ken Doy was awarded the MBE in 1976.

ABOVE: Boneham and Turner took over British Aero Components Ltd (BAC) in 1976.

ABOVE AND LEFT: Castleisland under construction in 1975, and the staff at BMP in 1976.

1980 1983 1993 1995 SFC-KOENIG

1980s

A SIGN OF THE TIMES: The mid 1970's had seen the UK almost bankrupt. The country had borrowed $3.6bn from the IMF. Businesses had not invested enough, union control, poor quality and over manned factories lead to global uncompetitiveness. British manufactured machine tools were 8% of World sales in 1971 and fell to 3% by the early 1980's. Manufacturing methods and the numerical control saw Japan boom and the UK fall.

1980 Spindle sales began to plummet from 1980. CNC controlled milling machines replaced fine boring. The first wave of very serious redundancies came in March 1981 as spindle sales halved. Regrettably 35 people were lost, 27 from production and 8 from senior management. This would be the beginning of the contraction of the company.

Nicholas Boneham became a Director of the company during 1981.

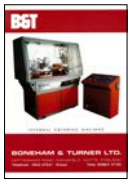
A SIGN OF THE TIMES: In 1980 British Steel was entered into the Guinness Book of Records as the most unprofitable company ever, a £1.8billion loss. In the early 1980's 2 million people lost their jobs in manufacturing at a rate 0f 20,000 per week.

During the 1980's Boneham and Turner balanced turbines for the large RB 211 Trent jet engine. A special facility was built at Nottingham Road for the operation.

1983 The Castleisland factory was closed in the early 1980's and the majority of machinery squeezed into Nottingham Road. Continued market contractions also saw the sale of the Field Mill as production was consolidated further at Nottingham Road.

Despite the decline. Boneham and Turner continued to build Fine Boring machines on a tool room basis. 3 large DE 585 machines were manufactured for Istanbul Piston Company in Turkey. It was also during the mid 1980's that the company built internal grinders. These were used throughout the factory and also 6 or 7 sold to customers.

Charles Boneham joined the company in 1988.



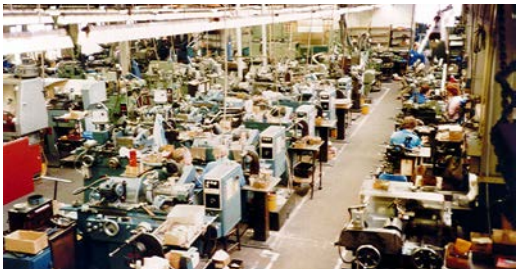
ABOVE LEFT TO RIGHT: Boneham and Turner DE 585 fine boring machine.

Balancing turbines for the large RB 211 Trent jet engine.

Boneham and Turner internal grinder.

ABOVE: Nottingham Road works in 1980.

1990s



ABOVE: Boneham and Turner's shop floor during the 1990's.

DRILL BUSHINGS took a back seat in the US after the changes in motor manufacturing practices. It was decided that spindles would take the majority of the focus.

1993 Boneham and Turner became strongly involved with a research project run by the Advanced Manufacturing and Technology Research Institute. The project was to produce a machine tool spindle that embodied many new advanced features. Increased power, high and low speed agility, and automatic tool change.

With margin erosion during the 1990's and further loss of labour the company developed relationships globally to manufacture periphery products and establish mutual business. This shift in mentality saw the addition of new products.

1995 The company invested in an S40 Studer CNC grinder at a cost of around £120,000.

Concentration began to lean towards factored goods with more emphasis placed on the Koenig Expander plug.

LEFT: The S40 Studer CNC grinder being delivered in 1995.

www.boneham.co.uk / Tel: +44 (0) 1623 445 450 / Fax: +44 (0) 1623 445 451 / sales@boneham.co.uk

2003 2007 2008 2015 2016 2017 2018

2000s

2003 The spindle business was sold to Jena Tec (Avingtrans) in 2003, with a significant amount of machinery and personnel moving to the Sherwood Park site in Annesley.

Charles Boneham became a Director of the company in 2003.

Peter Boneham joined the company in 2006.

2007 The company finally managed to sell the Nottingham Road site. The 68,000 Sq.ft site had become too much to maintain, was inefficient and too big for manufacturing tooling components. Aldi supermarket purchased the site.

2008 Boneham and Turner relocated to Oddicroft Lane. With focus solely on the manufacture of tooling components and shims.

The company went through an intensive process of disposing of many machines and equipment, whilst investing in some new Mori Seiki CNC machines and automated Kardex storage systems.

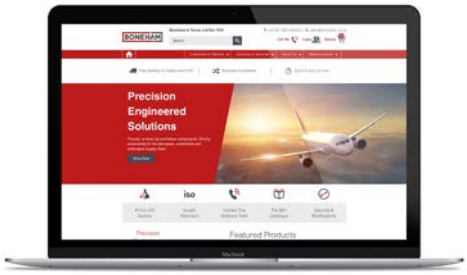
2009 Late in 2008/09 the recession hit the company. Product lines focussed on the automotive market fell overnight with a 40% drop in sales. The company reacted with 3 day working weeks and pay cuts. The support of all the team meant the company maintained all its workforce.

New lines were added in the later 2010's to extend the company's catalogue to over 200 pages.

TOP LEFT: Nottingham Road works being demolished in 2007.

ABOVE CLOCKWISE: Boneham and Turner relocated to Oddicroft Lane in 2008.

2010s



ABOVE: Boneham and Turner's new and improved e-commerce platform.

THE COMPANY began to recover during the early part of the 2010's, sales began to increase and the company began investing in marketing and customer focused activities such as an improved e-commerce platform.

Peter Boneham became a Director of the company in 2015.

2015 In January 2015, Boneham and Turner agreed to become the UK agent for US manufactured DADCO gas springs.

2016-18 Have been strong years for the company with 40% growth over the period and over 20,000 orders shipped since 2017.

2017-18 Has seen the largest amount of investment in manufacturing for a number of years, with over £700,000 worth of new machinery including two new Citizen sliding head lathes, a XYZ VMC, a Doosan Lynx, 3 Delapena honing machines and grinding machines.

2018 A Mezzanine level was constructed to increase the stores capacity by 40%.

2018 will also see the completion of a full drill bushing manufacturing line in the US with the aim of offering a one week turnaround premium service. The production line also includes internal heat treatment and blacking.

LEFT: First of the machines; part of the production line investment at Boneham Metal Products.

BONEHAM®

Celebrating 100 YEARS 1918 – 2018

Precision Engineered Solutions

The Boneham Group's philosophy is to build a solution around **customer specific requirement**. We tailor the resources we have available to customer and market circumstance. We strive to ensure all customer obligations are met, combining the important elements that allow our customers to competitively manufacture or supply products, build production lines, or create innovation of the future, on a global scale.

ENGINEERING & PRODUCTION KNOWLEDGE

Manufacture has been at the very heart of Boneham & Turner since 1918. The organisation has developed and nurtured skills, resulting in technical knowhow. We support all aspects of the supply chain in providing the right solution and advice.

INTERNAL STOCK MANAGEMENT

Inventory and manufacturing processes have been developed to ensure maximum availability. We are committed to working with our customers to ensure on-time and in-full delivery, ensuring stock of standard and special items are always available. Customer relationships and insight are paramount to Boneham.

VOLUME TAILORED PRICING

Manufacturing and sourcing procedures are under a constant improvement process, allowing tailored pricing for volume and key customer levels. Our flexible solutions adapt to customer requirement.

UK MANUFACTURE & SUPPORT

The Boneham Group Manufacturing Centre in the UK specialises in turning, milling, grinding and pressing. Adopting lean principles, our engineers aim for efficiency and speed to deliver standard and special solutions to customer requirement.

QUALITY GUARANTEED

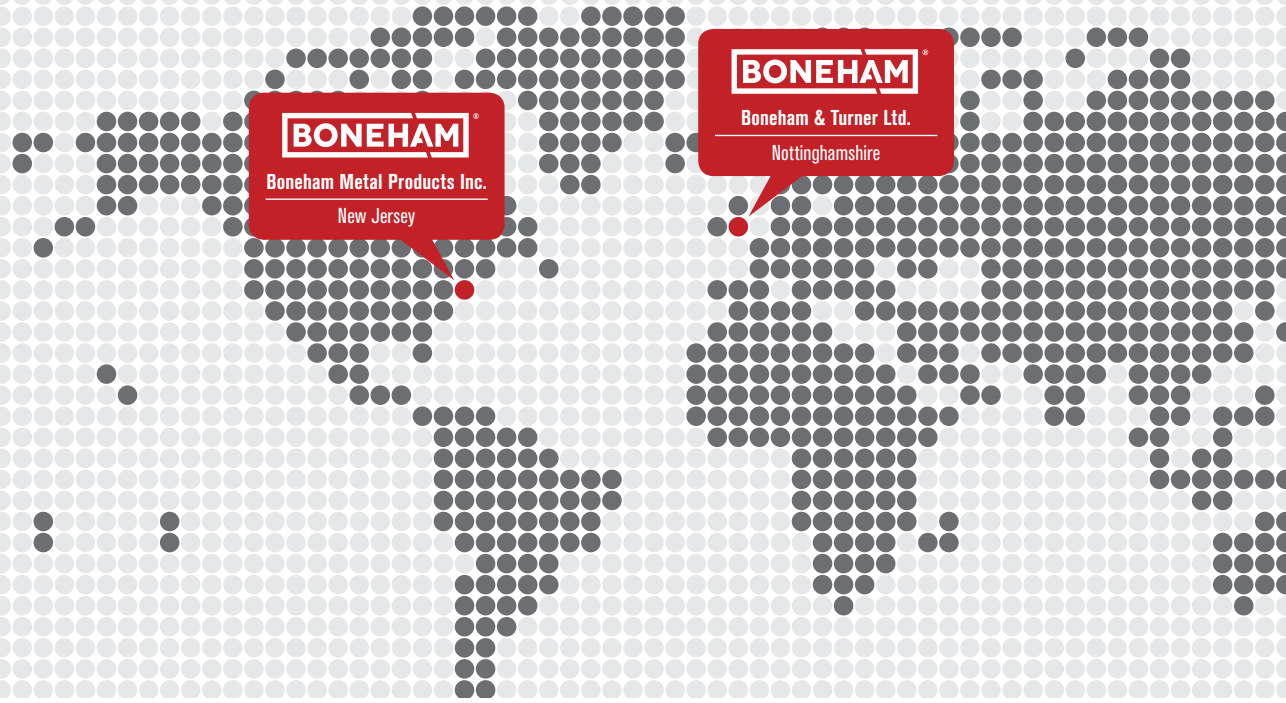
Boneham & Turner operates with strict quality procedures and principles. All products follow a consistent and recorded process. Products can be released in accordance with our AS9100D accreditation.

A global leader in the manufacture and supply of drill bushes, the Boneham brand offers the broadest inventory in the UK of drill bushes, dowel pins, location bushes, pins and miniature flow control components. Utilising the company's manufacturing facility and global supply chain partnerships, the company has assembled a catalogue of parts essential for the manufacture and assembly of; jigs and fixtures, work holding, hydraulic systems, machine building and tool manufacture.

SFC KOENIG EXPANDER®

SP SHIMPRESS Precision Shim Solutions

DADCO



Quality & Excellence

The Boneham brands reputation for quality and excellence has been the central factor behind the company's success since 1918. Emphasis on precision and quality has allowed the company to be at the forefront across a wide variety of markets including; aerospace, automotive, auto-sport, power generation, MOD and machine building.

Overseas, Boneham's reputation has become well known and the company's products are being used in most, if not all Continents of the World. A sister company in the US, Boneham Metal Products Inc. has manufacturer's reps and distributors throughout all states, operating out of a central hub in New Jersey. The company's commitment to providing quality solutions, supported by a service that is second to none, is a philosophy that has long been associated with the Boneham family, who still own and manage the organisation.


bsi.
Certificate of Registration
QUALITY MANAGEMENT SYSTEM - EN 9100:2018

Northwest Aerospace Alliance

MADE IN THE MIDLANDS

Composites UK
Member Company

bsi. AS/EN 9100 Series Aviation, Space and Defense
FM 682749

www.boneham.co.uk / Tel: +44 (0) 1623 445 450 / Fax: +44 (0) 1623 445 451 / sales@boneham.co.uk

Contacting and Ordering

Boneham Sales Technicians are on hand to advise on the best solutions available from a large portfolio of precision components.

Stocked items are generally sent out same day on a next day tracked courier service.

For enquiries or to order:

Call sales: 01623 445 450
Fax sales: 01623 445 451

Our lines operate from 8.30am until 5.30pm Monday to Friday.

Email sales:

sales@boneham.co.uk

For online information:

www.boneham.co.uk
(Buy Online/Download Catalogue)
www.koenigexpander.co.uk
(Download Catalogue)
www.shimpress.co.uk
(Buy Online/Download Catalogue)

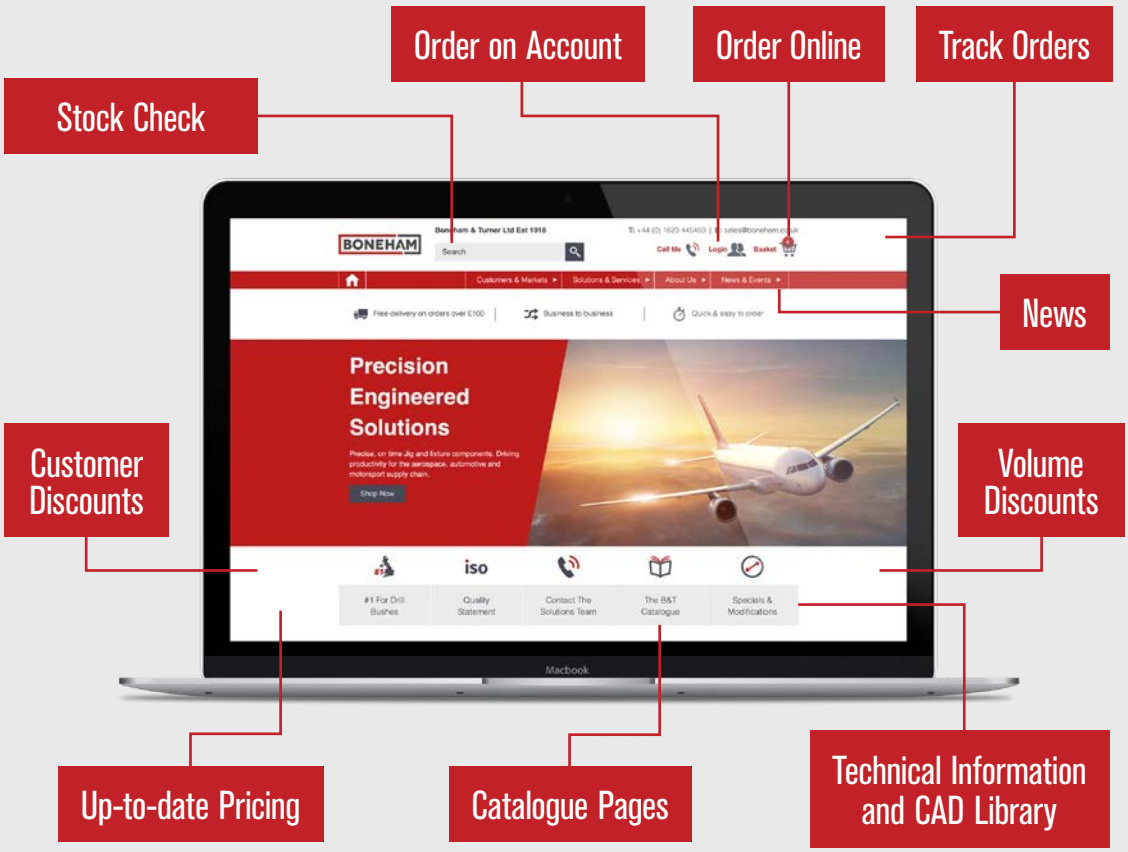
Methods of payment

To make payment easier for you, Boneham & Turner offer the following payment methods:

Boneham & Turner offer a 30-day credit account service. Please request a credit application form by email, or call our Technical Sales Team.

All major Credit/Debit Cards accepted
BACS/Cash/Cheque on collection.

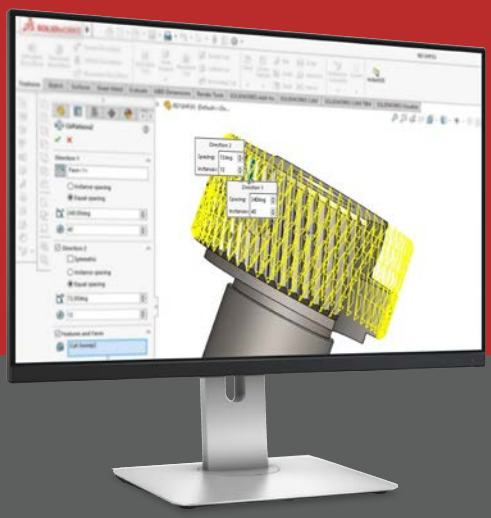
Precision Engineered Solutions



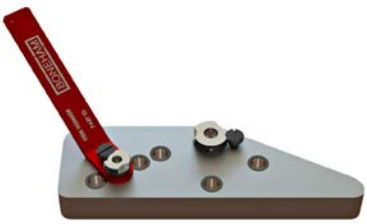
www.boneham.co.uk

A host of information, or your solution delivered, 24/7 on any device

All our products are available in CAD formats



To design Boneham products into a project, please contact the Technical Sales Team and request the CAD file you require.



SIX REASONS
TO CHOOSE BONEHAM®

1 BSI ISO QUALITY ASSURANCE

Boneham and Turner are an AS9100 Rev D approved company. We can manufacture and release in accordance with Aerospace AS9100 compliance or in accordance with ISO 9001 2015.

2 BONEHAM PRODUCT SOURCING: PRECISION PARTS SOURCED

Although Boneham's are proud to remain a British manufacturer, the company has a global reach, with supplier relationships spanning the World. B&T have the ability to provide quality precision engineered components at the right price, reliably.

3 NEXT-DAY NATIONWIDE DELIVERY

All stocked items are shipped out on a next day delivery. Boneham & Turner prides itself on responding to customer requirements, stocking standard and special items to schedules and call offs.
93% of the Boneham range is serviced from stock.

4 BONEHAM STANDARD PRECISION

The Boneham team is made up of time served engineers, carrying a wealth of engineering knowledge and experience. The company is built on these engineering foundations bringing 'Precision as Standard'.

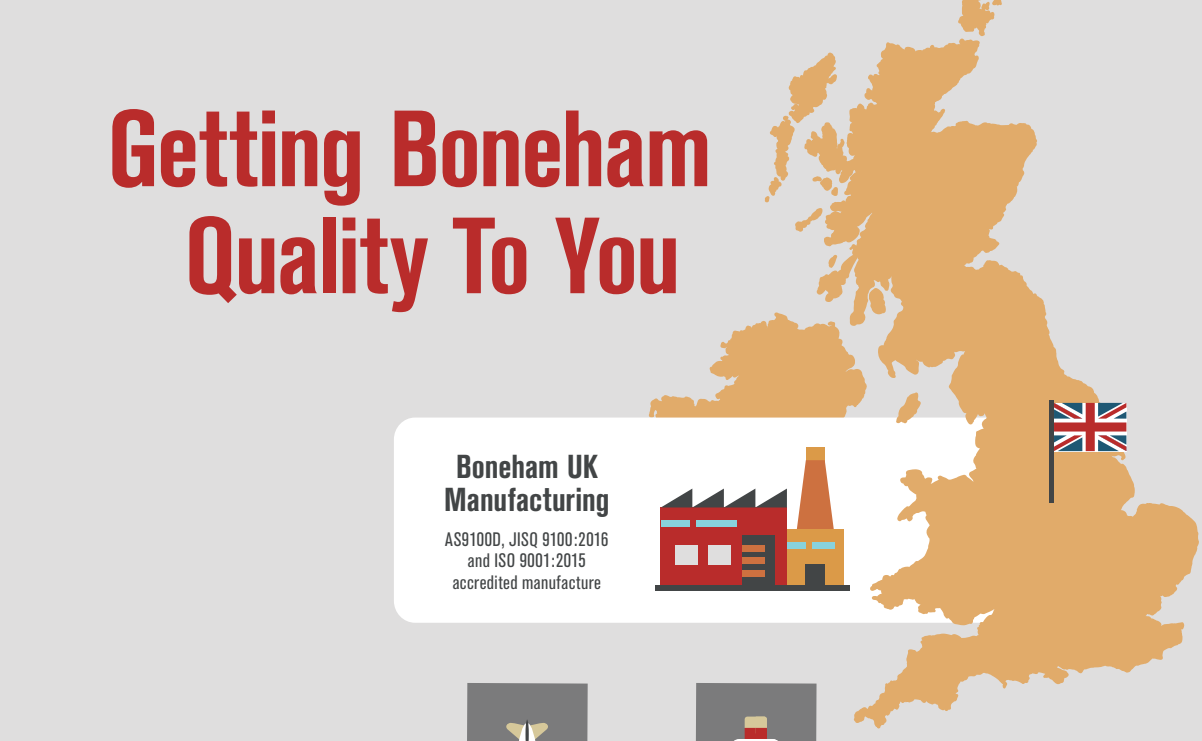
5 E-COMMERCE WEB PORTAL

www.boneham.co.uk "Precision Engineered Solutions" – Most of Bonehams range of components are available to buy online, with an easy ordering process and no minimum order, or credit card surcharges and the ability to order 24/7.

6 UK MANUFACTURING BONEHAM PRECISION

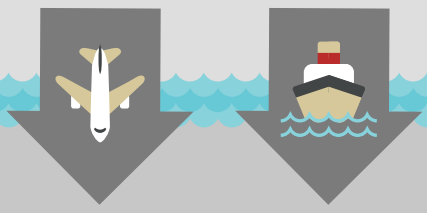
Boneham's manufacturing facility, which has been the backbone of the company since 1918, allows for the manufacture of special and standard items, including modifications. Our manufacturing capability allows for quicker turnarounds and traceability. The UK manufacturing capacity is detailed on page 95 or www.boneham.co.uk.

Getting Boneham Quality To You



Boneham UK Manufacturing

AS9100D, JISQ 9100:2016 and ISO 9001:2015 accredited manufacture



Boneham Metal Products

Sales

US in-house modifications

Fast Track Premium Specials

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

Index

BONEHAM®

Produced and supplied by Boneham & Turner for over 100 years. With so many variations of sizes, it takes years of experience and knowledge to service customers from stock. Special versions of the Boneham range can be quoted and manufactured to suit customer requirement.

HUGE STOCKS

VOLUME DISCOUNT

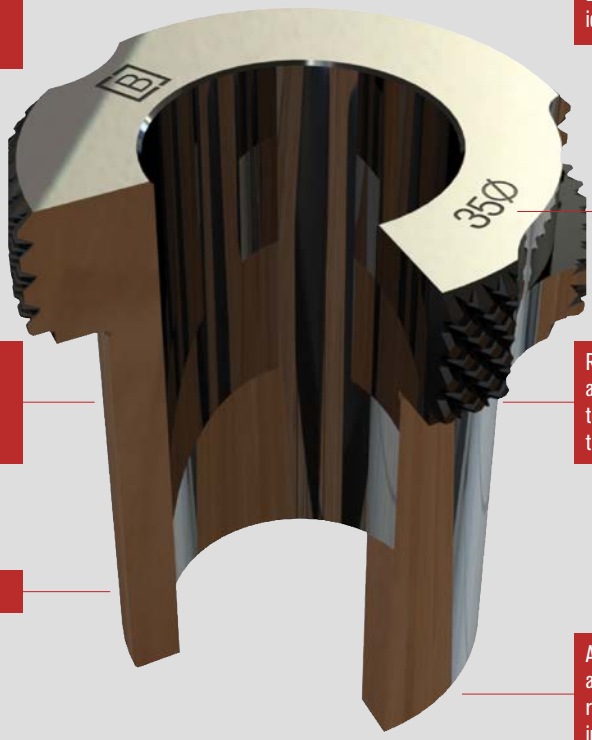
BONEHAM® BUSHES

The Difference

Boneham Drill Bushes are manufactured to the highest quality with dedication to superior concentricity and tolerances. Boneham bushes provide the accuracy required for precise drilling and alignment.

Blacked on unground surfaces for superior finish and recognition.

Bore size marked for easy identification in application.



Boneham bushes feature an undercut and grinding to the head to provide a flush fitting in the jig.

RD, RPS, SF and SFM bushes are deep knurled on the head to allow for easy removal in the oiliest of environments.

Heat treated to 58-62 HRC.

All bushes feature internal and external chamfers and radii to reduce wear and improve chip control.

Manufactured from quality EN31 bearing steel which has a high degree of hardness and abrasion resistance. Special material options can be manufactured including Boneham's famous Nitralloy, Carbide, 300 and 400 series stainless and tool steels.

Standard Jig Bushes

Metric Range
ISO and DIN standards

Page 34

PP. HEADLESS TYPE. PRESS FIT BS 1098 PT.2 1977/ISO 4247/DIN 179A

/ This type of bush is normally used for all jigs where an economical bush is required.
/ They also afford the minimum spacing between bushes.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Page 36

PH. HEADED TYPE. PRESS FIT. BS1098 PT.2 1977/ISO 4247/DIN 172A

/ This range is the same as type PP but headed. The head is convenient for pressing the bush home.
/ The head is also useful when it is desired to feed down to a dead stop.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Page 41

RD. FIXED AND SLIP RENEWABLE

/ These two features are incorporated on one bush, which is used in conjunction with liner bushes, and is held in place by a lock screw, tenon or stop pin.
/ The bush is a slide fit in its corresponding liner.
/ The removable fixed feature of the bush is normally used on high production work, when the bush can be easily and quickly replaced with a minimum loss of production.
/ The removable slip feature of the bush is used when more than one operation is carried out, when the bush is instantly removable after each operation.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Page 46

LP. HEADLESS LINER TYPE

/ This range is for use in conjunction with Renewable Fixed and Slip type bushes.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Page 47

LH. HEADED LINER TYPE

/ This range is the same as the plain liner but headed.
/ The shallow head can be left standing proud or countersunk flush.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Standard Jig Bushes

Imperial Range
BS standards

Page 35

HEADLESS TYPE. PRESS FIT. BS 1098 PT.1 1967

/ This type of bush is normally used for all jigs where an economical bush is required.
/ They also afford the minimum spacing between bushes.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Page 37

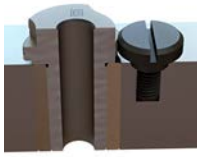
HEADED TYPE. PRESS FIT. BS 1098 PT.1 1967

/ This range is the same as the plain type but headed. The head is convenient for pressing the bush home.
/ The head is also useful when it is desired to feed down to a dead stop.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Page 42

FIXED AND SLIP RENEWABLE. BS 1098 PT.1 1967

/ These two features are incorporated on one bush, which is used in conjunction with liner bushes, and is held in place by a lock screw.
/ The bush is a slide fit in its corresponding liner.
/ The removable fixed feature of the bush is normally used on high production work, when the bush can be easily and quickly replaced with a minimum loss of production. The removable slip feature of the bush is used when more than one operation is carried out, when the bush is instantly removable after each operation.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.



Page 48

HEADLESS LINER TYPE. BS 1098 PT.1 1967

/ This range is for use in conjunction with Renewable Fixed and Slip type bushes.
/ The reference system used matches up with the corresponding slip bush.
/ For example a PL3 Liner bush suits an RPS3 Slip bush and so on.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Page 48

HEADED LINER TYPE. BS 1098 PT.1 1967

/ This range is the same as the plain liner but headed.
/ The shallow head can be left standing proud or counterbored flush.
/ Boneham bushes adhere to strict tolerance and concentricity guidelines.

Standard Jig Bushes

Boneham Standard Parts

Page 38

GS RECESSED SERRATED DRILL JIG BUSHES – IMPERIAL AND METRIC

/ GS Bushes feature outside diameter serrations for pressing, moulding or casting into plastic based materials.
/ Feature radial groove locks the bush in place to allow downward load pressure.
/ Perfect as a location bush in composite, glass fibre, carbon fibre and synthetic resin.

Pages 52-53

ANCHOR DRILL BUSHES AB1 | AB2 | AB3 IMPERIAL AND METRIC

/ Two-piece assembly for riveting or welding to the template.
/ The strap anchors the bush whilst the spigot on the hardened body locates accurately into the plate.
/ Standard and corner versions for maximum pattern capability.

Page 44

HANDLE BUSHES HB AND HBM IMPERIAL AND METRIC

/ For use with RD, RPS, SF and SFM drill bushes.
/ Aluminum lightweight handle in Boneham red.
/ Reusable and includes the lock screw.

Popular Boneham Drill Bushings in Application

BONEHAM USA

From the American Standard Range ANSI / ASME

IMAGE	ANSI TYPE	DESCRIPTION
	P PTW PM NP	Headless press fit drill bushings are normally used in jigs where an economically priced drill bushing is required. These drill bushings are also often used where less space is available on the jig plate. Headless press fit drill bushings are pressed into the plate to achieve a flush surface in conjunction with a simple drilling and reaming operation. Headless drill bushings have less resistance than the headed type when subjected to large axial loads.
	H HTW HM NH	Headed press fit drill bushings are dimensionally identical to the headless range, but for the head. Headed press fit drill bushings contain a shoulder at the top of the bush to allow greater axial force on the jig, and aids where it is desired, to feed down to a dead stop. The head of the bushing can be pressed into the plate easier and can be left either exposed above the plate surface or counter bored to sit flush.
	SP SPM	Serrata Press Fit Drill Bushings are a part serrated drill bushing similar to the 'P Type' bushing but for a half-serrated OD. These bushings are designed to press into soft materials such as wood, plastics and soft metals. The top half of the bushing OD is serrated to prevent rotational movement and increased axial resistance in the jig or fixture. The second half of the Serrata press fit bushing is finish ground for accurate and easy location and positioning.
	DG DGM	Diamond Groove Drill Bushings are fully diamond knurled. They are designed to be cast-in to the fixture or mold. Composite resin runs through the grooves to lock the bushing in place. The combination of the groove(s) and the diamond knurling form a strong resistance to axial and rotational movement. Serrated or diamond knurled bushings do not feature a ground outside diameter, whilst this makes them more economical, the bushing must be accurately located using the bore. Alignment pins can be used where appropriate in a fixture.
	L LTW SF SFM LS	Slip-Fixed Renewable Drill Bushings incorporate two features on one bush. Used in conjunction with liner bushings, Slip-Fixed Renewable Drill Bushings can be held in place by a lock screw, tenon or stop pin. The bushing is a slide fit in its corresponding liner, which allows for accurate alignment and easy replacement. The removable fixed feature of the bushing is normally used in high production work. The bushing can be easily and quickly replaced with a minimum loss of production. The removable slip feature of the bushing is used when more than one operation is carried out. Many drill sizes can be used with one bushing liner. The bushing is instantly removable after each operation. Both methods are designed to speed up operations and improve productivity. The knurled head allows for easy handling of the bushing to enable it to be rotated out of the removable slip feature.
	HL SF SFM LS	
	A2100 A2200 A2300	Air-feed bushings are a threaded locking collar and drill bushing shank. They are designed for use with air-feed drills, rackfeeds, tappers and spotfaces. The collar screws into the air-feed drill's nosepiece, precisely aligns the shank, and locks the drill in place when rotated into the liner. Boneham Air-feed bushings are manufactured to order.

Standard Jig Bushes

STANDARD INCREMENT BORE SIZES FOR BONEHAMS METRIC JIG BUSH RANGE

From 1.0mm to 3mm in steps of 0.05mm
From 3mm to 14mm in steps of 0.1mm and including all 0.25mm and 0.75mm sizes
From 14mm to 33mm in steps of 0.25mm
From 33mm to 51mm in steps of 0.5mm
From 51mm to 100mm in steps of 1.0mm

Note

/ ALL other sizes are regarded as specials. Bushes with a bore size above 48mm may not always be stocked sizes.
/ Specials manufactured to customer requirements.
/ USA Bushings ANSI standards including thin wall range available (Pages 99-117).

I.S.O. Limits for Reference in connection with Drill Bushes Unit = 0.001mm												Limits for Bores* of Reamer Bushes	
Nominal Sizes		H6 Hole		F7 Hole		n6 Shaft		m6 Shaft		h13 shaft			
Over	Up to	High+	Low	High+	Low+	High+	Low+	High+	Low+	High	Low-	High+	Low+
-	3	6	0	16	6	10	4	8	2	0	140	18	11
3	6	8	0	22	10	16	8	12	4	0	180	23	15
6	10	9	0	28	13	19	10	15	6	0	220	27	18
10	18	11	0	34	16	23	12	18	7	0	270	31	21
18	30	13	0	41	20	28	15	21	8	0	330	38	25
30	50	16	0	50	25	33	17	25	9	0	390	46	30
50	80	19	0	60	30	39	20	30	11	0	460	-	-
80	120	22	0	71	36	45	23	35	13	0	540	-	-

FITTING INSTRUCTIONS FOR IMPERIAL BUSHES

Recommended limits, shown below to which receiving holes should be bored or reamed so that bushes are a suitable press fit.

BS1916 H6 LIMITS

Dimensions in inches

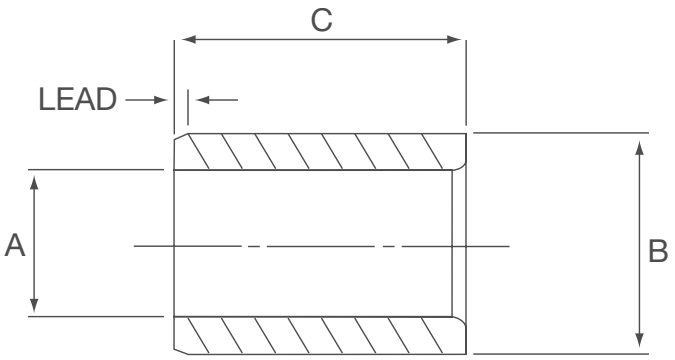
BORE	.120 to.240	.240 to.710	.710 to 1.190	1.190 to 1.970	1.970 to 3.150
LIMITS	-.0000	-.0000	-.0000	-.0000	-.0000
	+.0003	+.0004	+.0005	+.0006	+.0007

/ Concentricity is .0008" on drilled or ground bores up to .055".

/ USA Bushings ANSI standards including thin wall range available.
/ Serrated Bushes available.

Plain Jig Bushes – Metric

BS 1098 PT. 2 1977/ISO 4247/DIN 179A



HUGE STOCKS

VOLUME DISCOUNT

KEY FEATURES
/ Hardened from 58 to 62 RC
/ F7 ID drill limits
/ OD ground to suit H6 limits
/ Radius for easy drill entry
/ Lead for easy drill bush location

ORDERING INSTRUCTIONS
/ Nitrided bushes for longer life can be supplied.
/ State: Qty, Type, Bore Size and Length
/ Example: 5, PP15E 10mm

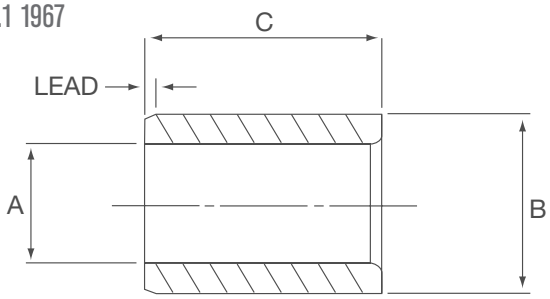
NOTES
See page 33 for table showing ISO Limits for Jig Bushes and standard bore sizes. *(Also Reamer Limits.)
/ Bushes with a bore size above 48mm may not be stock items.
/ Price and delivery on application.
/ Some overlap sizes avaliable from stock.

A Dia. F7 Limits (Drills) *Limits (Reamers)		B Dia. n6 Limits	Length C and Bush Reference					
			Short		Long		Extra Long	
From	Up to		C	Ref.	C	Ref.	C	Ref.
-	1	3	6	PP3A	9	PP3C	-	-
1.05	1.8	4	6	PP4A	9	PP4C	-	-
1.85	2.6	5	6	PP5A	9	PP5C	-	-
2.65	3.3	6	8	PP6B	12	PP6E	16	PP6F
3.4	4	7	8	PP7B	12	PP7E	16	PP7F
4.1	5	8	8	PP8B	12	PP8E	16	PP8F
5.1	6	10	10	PP10D	16	PP10F	20	PP10H
6.1	8	12	10	PP12D	16	PP12F	20	PP12H
8.1	10	15	12	PP15E	20	PP15H	25	PP15J
10.1	12	18	12	PP18E	20	PP18H	25	PP18J
12.1	15	22	16	PP22F	28	PP22K	36	PP22N
15.25	18	26	16	PP26F	28	PP26K	36	PP26N
18.25	22	30	20	PP30H	36	PP30N	45	PP30R
22.25	26	35	20	PP35H	36	PP35N	45	PP35R
26.25	30	42	25	PP42J	45	PP42R	56	PP42S
30.25	35	48	25	PP48J	45	PP48R	56	PP48S
35.50	42	55	30	PP55L	56	PP55S	67	PP55T
42.50	48	62	30	PP62L	56	PP62S	67	PP62T
48.50	55	70	30	PP70L	56	PP70S	67	PP70T
56	63	78	35	PP78M	67	PP78T	78	PP78W
64	70	85	35	PP85M	67	PP85T	78	PP85W
71	78	95	40	PP95P	78	PP95W	105	PP95Y
79	85	105	40	PP105P	78	PP105W	105	PP105Y
86	95	115	45	PP115R	89	PP115X	112	PP115Z
96	105	125	45	PP125R	89	PP125X	112	PP125Z

All dimensions in millimetres

Plain Drill Bushes – Imperial

BS 1098 PT.1 1967



HUGE STOCKS

VOLUME DISCOUNT

ORDERING INSTRUCTIONS
/ Imperial bushes including metric bores.
/ Nitrided bushes for longer life can be supplied.
/ State: Qty, Type, Bore Size and Length
/ Example: 5, P6 3/8" x 3/4" lg

Note: All bores of the 32nd and 64th sizes over 1/2" diameter are now considered special. Standard bore sizes see chart page.

Oversize bushes: +,010"/+.015" on 'B' diameter can be supplied for finish grinding. State O/S if required after ref. Price on application. **Ream limits:** If required state R after ref. Price on application. Special bushes price on application.

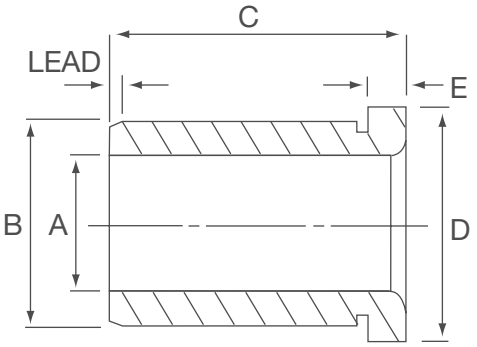
FITTING INSTRUCTIONS
Bore or Ream hole to dimension 'B' use H6 Limit when the Bush will be a suitable press fit.

A Dia. Range		B	Length C and Reference													
mm	Imp.	O.D.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 3/8"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"
1.2 to 2.35	.3/64 to 3/32	.2035 .2038	PB1	PB1	PB1	PB1										
2.4 to 3.5	7/64 to 9/64	.2505 .2508	P2	P2	P2	P2										
3.6 to 4.75	5/32 to 3/16	.3131 .3135		P3	P3	P3	P3	P3								
4.8 to 6.3	13/64 to 1/4	.4068 .4072		PB4	PB4	PB4	PB4	PB4								
6.4 to 7.9	17/64 to 5/16	.5006 .5010		P5	P5	P5	P5	P5								
8.0 to 10.3	21/64 to 13/32	.6257 .6262				P6	P6	P6	P6	P6						
10.4 to 12.6	27/64 to 1/2	.7507 .7512				P7	P7	P7	P7	P7						
12.75 to 15.75	9/16 to 5/8	.8757 .8762						P8	P8	P8	P8	P8				
16 to 19	11/16 to 3/4	1.0009 1.0015				P9		P9	P9	P9	P9	P9				
19.25 to 22	13/16 to 7/8	1.1884 1.1890						PB9	PB9	PB9	PB9	PB9	PB9			
22.25 to 25.25	15/16 to 1	1.3759 1.3765						P10	P10	P10	P10	P10	P10			
25.5 to 30	1 1/16 to 1 3/16	1.5635 1.5642							PB10	PB10	PB10	PB10	PB10	PB10	PB10	
30.25 to 34.5	1 1/4 to 1 3/8	1.7510 1.7517							P11	P11	P11	P11	P11	P11	P11	
35 to 39.5	1 7/16 to 1 9/16	2.0010 2.0017							PB11	PB11	PB11	PB11	PB11	PB11		PB11
40 to 44	1 5/8 to 1 3/4	2.2512 2.2520							P12	P12	P12	P12	P12	P12		P12

References shaded ▒ price on application

Headed Drill Jig Bushes – Metric

BS 1098 PT.2 1977/ISO 4247/DIN 172A



HUGE STOCKS

VOLUME DISCOUNT

KEY FEATURES
/ Hardened from 58 to 62 RC
/ F7 ID drill limits
/ OD ground to suit H6 limits
/ Radius for easy drill entry
/ Lead for easy drill bush location

ORDERING INSTRUCTIONS
/ Nitrided bushes for longer life can be supplied.
/ State: Qty, Type, Bore Size and Length
/ Example: 5, PH18E 10.1mm

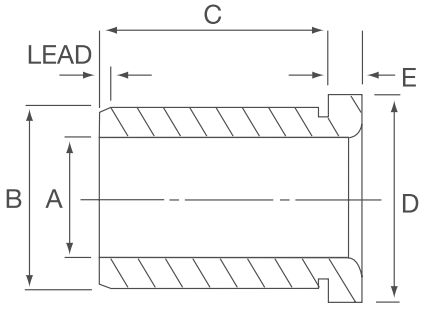
NOTES
See page 33 for table showing ISO Limits for Jig Bushes and standard bore sizes. *(Also Reamer Limits.)
/ Bushes with a bore size above 48mm may not be stock items.
/ Price and delivery on application
/ Some overlap sizes avaliable from stock.

A Dia. F7 Limits (Drills) *Limits (Reamers) From	Up to	B Dia. n6 Limits	Length C and Bush Reference Short C	Ref.	Long C	Ref.	Extra Long C	Ref.	D Dia. h13 Limits	E Length
-	1	3	6	PH3A	9	PH3C	-	-	6	2
1.05	1.8	4	6	PH4A	9	PH4C	-	-	7	2
1.85	2.6	5	6	PH5A	9	PH5C	-	-	8	2
2.65	3.3	6	8	PH6B	12	PH6E	16	PH6F	9	2.5
3.4	4	7	8	PH7B	12	PH7E	16	PH7F	10	2.5
4.1	5	8	8	PH8B	12	PH8E	16	PH8F	11	2.5
5.1	6	10	10	PH10D	16	PH10F	20	PH10H	13	3
6.1	8	12	10	PH12D	16	PH12F	20	PH12H	15	3
8.1	10	15	12	PH15E	20	PH15H	25	PH15J	18	3
10.1	12	18	12	PH18E	20	PH18H	25	PH18J	22	4
12.1	15	22	16	PH22F	28	PH22K	36	PH22N	26	4
15.25	18	26	16	PH26F	28	PH26K	36	PH26N	30	4
18.25	22	30	20	PH30H	36	PH30N	45	PH30R	34	5
22.25	26	35	20	PH35H	36	PH35N	45	PH35R	39	5
26.25	30	42	25	PH42J	45	PH42R	56	PH42S	46	5
30.25	35	48	25	PH48J	45	PH48R	56	PH48S	52	5
35.50	42	55	30	PH55L	56	PH55S	67	PH55T	59	5
42.50	48	62	30	PH62L	56	PH62S	67	PH62T	66	6
48.50	55	70	30	PH70L	56	PH70S	67	PH70T	74	6
56	63	78	35	PH78M	67	PH78T	78	PH78W	82	6
64	70	85	35	PH85M	67	PH85T	78	PH85W	90	6
71	78	95	40	PH95P	78	PH95W	105	PH95Y	100	6
79	85	105	40	PH105P	78	PH105W	105	PH105Y	110	6
86	95	115	45	PH115R	89	PH115X	112	PH115Z	120	6
96	105	125	45	PH125R	89	PH125X	112	PH125Z	130	6

All dimensions in millimetres

Headed Drill Jig Bushes – Imperial

BS 1098 PT.1 1967



HUGE STOCKS

VOLUME DISCOUNT

ORDERING INSTRUCTIONS
/ Imperial bushes including metric bores.
/ Nitrided bushes for longer life can be supplied.
/ State: Qty, Type, Bore Size and Length
/ Example: 5, S6 3/8" x 3/4" lg

Note: All bores of the 32nd and 64th sizes over 1/2" diameter are now considered special. Standard bore sizes see chart page.

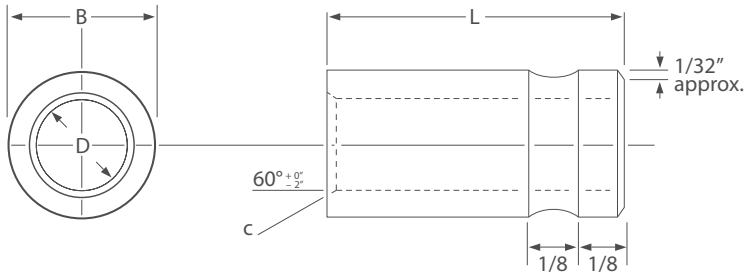
Oversize bushes: +,010"/+.015" on 'B' diameter can be supplied for finish grinding. State O/S if required after ref. Price on application. **Ream limits:** If required state R after ref. Price on application. Special bushes price on application.

FITTING INSTRUCTIONS
Bore or Ream hole to dimension 'B' use H6 Limit when the Bush will be a suitable press fit.

A Dia. Range		B	Length C and Reference													Head	
mm	Imp.	O.D.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 3/8"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	D	E
1.2 to 2.35	3/64 to 3/32	.2035 .2038	SB1	SB1	SB1	SB1											5/16	3/32
2.4 to 3.5	7/64 to 9/64	.2505 .2508	S2	S2	S2	S2											5/16	1/8
3.6 to 4.75	5/32 to 3/16	.3131 .3135		S3	S3	S3	S3	S3									3/8	1/8
4.8 to 6.3	13/64 to 1/4	.4068 .4072		SB4	SB4	SB4	SB4	SB4									9/16	3/16
6.4 to 7.9	17/64 to 5/16	.5006 .5010		S5	S5	S5	S5	S5	S5								5/8	3/16
8.0 to 10.3	21/64 to 13/32	.6257 .6262				S6	S6	S6	S6	S6							3/4	3/16
10.4 to 12.6	27/64 to 1/2	.7507 .7512				S7	S7	S7	S7	S7							15/16	1/4
12.75 to 15.75	9/16 to 5/8	.8757 .8762						S8	S8	S8	S8	S8					1 1/8	1/4
16 to 19	11/16 to 3/4	1.0009 1.0015				S9		S9	S9	S9	S9	S9					1 1/4	5/16
19.25 to 22	13/16 to 7/8	1.1884 1.1890						SB9	SB9	SB9	SB9	SB9	SB9				1 7/16	5/16
22.25 to 25.25	15/16 to 1	1.3759 1.3765						S10	S10	S10	S10	S10	S10				1 5/8	5/16
25.5 to 30	1 1/16 to 1 3/16	1.5635 1.5642							SB10	SB10	SB10	SB10	SB10	SB10	SB10		1 13/16	3/8
30.25 to 34.5	1 1/4 to 1 3/8	1.7510 1.7517							S11	S11	S11	S11	S11	S11	S11		2	3/8
35 to 39.5	1 7/16 to 1 9/16	2.0010 2.0017							SB11	SB11	SB11	SB11	SB11	SB11		SB11	2 1/4	3/8
40 to 44	1 5/8 to 1 3/4	2.2512 2.2520							S12	S12	S12	S12	S12	S12		S12	2 1/2	3/8

References shaded ▒ price on application

Polygrip Recessed Serrated Bushes



HUGE STOCKS

VOLUME DISCOUNT

MATERIAL

/ Carbon tool steel, hardened throughout.

NOTES

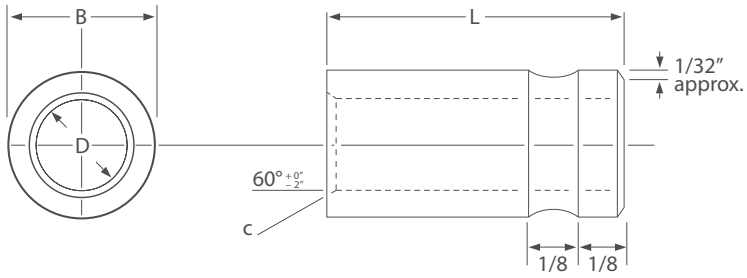
Serrated bushses are common place in glass fibre, composite or synthetic jigs. The serrations and grooved recess lock the bush in place and prevent axial movement. Unlike regular drill bushes, serrated bushes are not to tight tolerance unless requested. The grooved recess feature of our GS bushes allows for resin based materials to run into the channel and set the bush in place.

Bush Reference	"Bore Diameter D" From	To	Limits of Tolerance	Outside Diameter of Body B	Depth of Chamfer C	Length L
GS1	1/16 1.6mm	1/8 3.45mm	+0.0005 +0.0015	1/4	1/64	3/8
GS2				1/4	1/64	1/2
GS3				1/4	1/64	3/4
GS4	3/32 3.45mm	3/16 4.9mm	+0.0005 +0.0015	3/8	1/32	3/8
GS5				3/8	1/32	1/2
GS6				3/8	1/32	3/4
GS7	3/16 4.95mm	1/4 6.5mm	+0.001 +0.002	7/16	1/32	3/8
GS8				7/16	1/32	1/2
GS9				7/16	1/32	3/4
GS10	1/4 6.4mm	5/16 7.9mm	+0.001 +0.002	1/2	3/64	3/8
GS11				1/2	3/64	1/2
GS12				1/2	3/64	3/4
GS13	5/16 8.0mm	13/32 10.5mm	+0.001 +0.002	5/8	3/64	3/8
GS14				5/8	3/64	1/2
GS15				5/8	3/64	3/4

Unless otherwise stated, dimensions and tolerances shown in Inches.
Maximum eccentricity 0.003.

Soft Polygrip Serrated Bush

Polygrip Serrated GS Bush Soft Condition



VOLUME DISCOUNT

KEY FEATURES
/ Soft Natural Condition
/ Reworkable in the Mould

APPLICATION
Boneham Soft Serrated Bushes are designed to be reworked in a mould or fixture should alignment be slightly off-centre. They are for alignment purposes and not drilling applications. Tolerances and concentricity may differ to the standard hardened bush.

ORDERING INSTRUCTIONS
When ordering: Choose the ID required based on the pin size in use and select the part number form the corresponding length. Part numbers are formed using the 'Bush Reference' code followed by the bore size. For example: SFGS14-8.00MM

NOTES
Specials Manufactured by BONEHAM

INCH

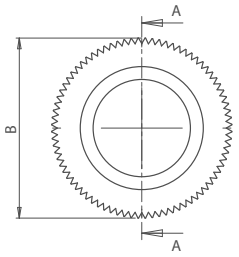
Part Code	Bore Dia (D)	Limits	OD (B)	Depth of Chamfer (C)	Length (L)
SFGS7-1/4"	1/4"	+0.001 / +0.002	7/16"	1/32"	3/8"
SFGS8-1/4"	1/4"	+0.001 / +0.002	7/16"	1/32"	1/2"
SFGS9-1/4"	1/4"	+0.001 / +0.002	7/16"	1/32"	3/4"
SFGS13-5/16"	5/16"	+0.001 / +0.002	5/8"	5/8"	3/8"
SFGS14-5/16"	5/16"	+0.001 / +0.002	5/8"	5/8"	1/2"
SFGS15-5/16"	5/16"	+0.001 / +0.002	5/8"	5/8"	3/4"

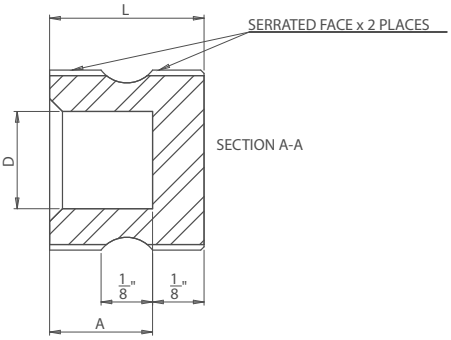
METRIC

Part Code	Bore Dia (D)	Limits	OD (B)	Depth of Chamfer (C)	Length (L)
SFGS7-6.00MM	6mm	+0.001 / +0.002	7/16"	1/32"	3/8"
SFGS8-6.00MM	6mm	+0.001 / +0.002	7/16"	1/32"	1/2"
SFGS9-6.00MM	6mm	+0.001 / +0.002	7/16"	1/32"	3/4"
SFGS13-8.00MM	8mm	+0.001 / +0.002	5/8"	5/8"	3/8"
SFGS14-8.00MM	8mm	+0.001 / +0.002	5/8"	5/8"	1/2"
SFGS15-8.00MM	8mm	+0.001 / +0.002	5/8"	5/8"	3/4"

Blind Polygrip Serrated Bush

Polygrip Serrated GS Bush Blind Hole





VOLUME DISCOUNT

KEY FEATURES
/ Carbon Tool Steel
/ Hardened
/ Blind Bore

APPLICATION
Boneham Blind Serrated Bushes are hardened like the standard GS bushes, but with a blind bore. The hardened nature of the bush provides protection for the mould integrity. These bushes retain the same features as the standard Polygrip Bushes. The serrations prevent rotational movement and the recess allows resin to lock the bush in place.

ORDERING INSTRUCTIONS
When ordering: Choose the ID required based on the pin size in use and select the part number form the corresponding length. Part numbers are formed using the 'Bush Reference' code followed by the bore size.
For example: BLGS14-8.00MM

NOTES
Specials Manufactured by BONEHAM

INCH

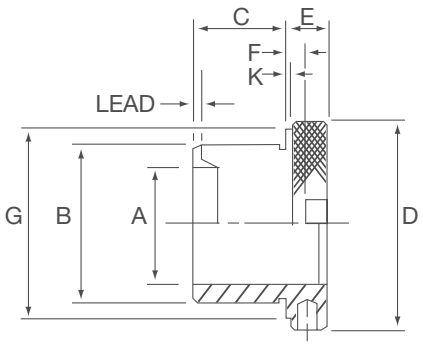
Part Code	Bore Dia (D)	Limits	OD (B)	Depth of Chamfer (C)	Length (L)
BLGS7-1/4"	1/4"	+0.001 / +0.002	7/16"	1/32"	3/8"
BLGS8-1/4"	1/4"	+0.001 / +0.002	7/16"	1/32"	1/2"
BLGS9-1/4"	1/4"	+0.001 / +0.002	7/16"	1/32"	3/4"
BLGS13-5/16"	5/16"	+0.001 / +0.002	5/8"	5/8"	3/8"
BLGS14-5/16"	5/16"	+0.001 / +0.002	5/8"	5/8"	1/2"
BLGS15-5/16"	5/16"	+0.001 / +0.002	5/8"	5/8"	3/4"

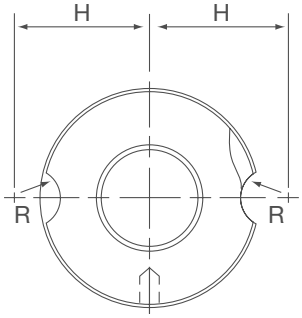
METRIC

Part Code	Bore Dia (D)	Limits	OD (B)	Depth of Chamfer (C)	Length (L)
BLGS7-6.00MM	6mm	+0.001 / +0.002	7/16"	1/32"	3/8"
BLGS8-6.00MM	6mm	+0.001 / +0.002	7/16"	1/32"	1/2"
BLGS9-6.00MM	6mm	+0.001 / +0.002	7/16"	1/32"	3/4"
BLGS13-8.00MM	8mm	+0.001 / +0.002	5/8"	5/8"	3/8"
BLGS14-8.00MM	8mm	+0.001 / +0.002	5/8"	5/8"	1/2"
BLGS15-8.00MM	8mm	+0.001 / +0.002	5/8"	5/8"	3/4"

Renewable Bushes

BS 1098 PT.2 1977/ISO 4247





HUGE STOCKS

VOLUME DISCOUNT

Key features
- / Hardened from 58 to 62 RC
- / F7 ID drill limits
- / OD ground to suit H6 limits
- / Radius for easy drill entry
- / Lead for easy drill bush location

ORDERING INSTRUCTIONS
- / Nitrided bushes for longer life can be supplied.
- / State: Qty, Type, Bore Size and Length.
- / Example – 5, RD12E 6mm.

NOTES

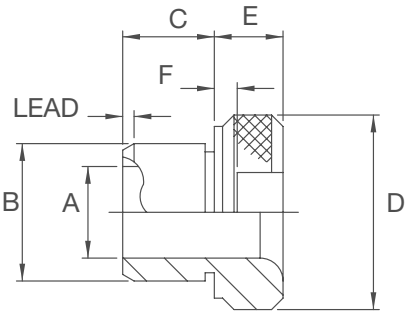
See page 33 for table showing ISO Limits for Jig Bushes and standard bore sizes. *(Also Reamer Limits.)
- / Bushes with a bore size above 48mm may not be stock items.
- / Price and delivery on application.

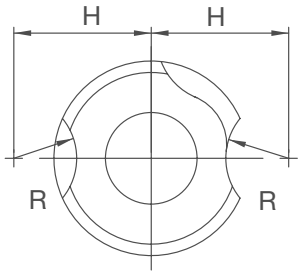
A Dia. F7 Limits (Drills) *Limits (Reamers) From	Up to	B Dia. m6 Limits	Length C and Bush Reference Short C	Ref.	Long C	Ref.	Extra Long C	Ref.	D Dia.	G Dia. +0 - 0.25	E Length	F Thickness	K Length	H	R Rad
1.0	4	8	10	RD8D	16	RD8F	-	-	15	12	8	3	1	11.5	7
3.7	6	10	12	RD10E	20	RD10H	25	RD10J	18	15	8	3	1	13	7
5.7	8	12	12	RD12E	20	RD12H	25	RD12J	22	18	10	4	1	16	8.5
7.7	10	15	16	RD15F	28	RD15K	36	RD15N	26	22	10	4	1	18	8.5
9.6	12	18	16	RD18F	28	RD18K	36	RD18N	30	26	10	4	1	20	8.5
11.5	15	22	20	RD22H	36	RD22N	45	RD22R	34	30	12	5.5	1	23.5	10.5
14.5	18	26	20	RD26H	36	RD26N	45	RD26R	39	35	12	5.5	1	26	10.5
17.5	22	30	25	RD30J	45	RD30R	56	RD30S	46	42	12	5.5	1	29.5	10.5
21.5	26	35	25	RD35J	45	RD35R	56	RD35S	52	46	12	5.5	1.5	32.5	10.5
25.5	30	42	30	RD42L	56	RD42S	67	RD42T	59	53	12	5.5	1.5	36	10.5
29	35	48	30	RD48L	56	RD48S	67	RD48T	66	60	16	7	2	41	12.5
34	42	55	30	RD55L	56	RD55S	67	RD55T	74	68	16	7	2	45	12.5
41	48	62	35	RD62M	67	RD62T	78	RD62W	82	76	16	7	2	49	12.5
47	55	70	35	RD70M	67	RD70T	78	RD70W	90	84	16	7	2	53	12.5
53	63	78	40	RD78P	78	RD78W	105	RD78Y	100	94	16	7	2	58	12.5
61	70	85	40	RD85P	78	RD85W	105	RD85Y	110	104	16	7	2	63	12.5
68	78	95	45	RD95R	89	RD95X	112	RD95Z	120	114	16	7	2	68	12.5
76	85	105	45	RD105R	89	RD105X	112	RD105Z	130	124	16	7	2	73	12.5

All dimensions in millimetres

Renewable Bushes

BS 1098 PT.1 1967





HUGE STOCKS

VOLUME DISCOUNT

ORDERING INSTRUCTIONS
/ Imperial bushes including metric bores.
/ Nitrided bushes for longer life can be supplied.
/ State: Qty, Type, Bore Size and Length
/ Example: 10, RPS3 12mm x 1" lg

Note: All bores of the 32nd and 64th sizes over 1/2" diameter are now considered special.
Standard bore sizes see chart page 51.
/ The above Bushes are used in conjunction with Plain and Headed Liners and Lock Screws, as shown on pages 48 and 49.
Ream limits: If required state R after ref. Price on application.
/ Special bushes price on application.

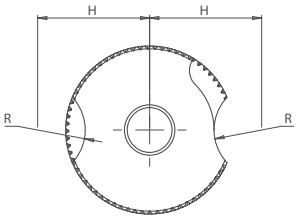
A Dia. Range mm	A Dia. Range Imp.	B O.D.	Length C and Reference 5/16"	3/8"	1/2"	3/4"	1"	1 1/4"	1 3/8"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"
1.2 to 4.75	3/64 to 3/16	.3123 .3125	RPS1	RPS1	RPS1	RPS1								
3.9 to 8.7	5/32 to 11/32	.4997 .5000	RPS2	RPS2	RPS2	RPS2	RPS2	RPS2						
7.6 to 12.6	19/64 to 1/2	.7496 .7500			RPS3	RPS3	RPS3	RPS3		RPS3				
12.4 to 19.0	31/64 to 3/4	.9996 1.0000				RPS4	RPS4	RPS4	RPS4	RPS4	RPS4	RPS4		
17.5 to 26.75	11/16 to 1 1/16	1.3746 1.3750				RPS5	RPS5	RPS5	RPS5	RPS5	RPS5	RPS5	RPS5	
25.25 to 34.5	1 to 1 3/8	1.7496 1.7500					RPS6	RPS6	RPS6	RPS6	RPS6	RPS6	RPS6	RPS6
33.0 to 45.0	1 5/16 to 1 3/4	2.2495 2.2500					RPS7	RPS7	RPS7	RPS7	RPS7	RPS7	RPS7	RPS7

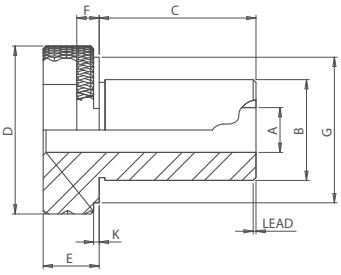
References shaded price on application

Ref.	Head Dimensions in inches D	E	F	R	H
RPS1	9/16	3/8	1/8	11/32	1/2
RPS2	13/16	3/8	1/8	11/32	5/8
RPS3	1 1/16	3/8	1/8	11/32	3/4
RPS4	1 7/16	7/16	1/8	11/32	59/64
RPS5	1 25/32	7/16	1/8	11/32	1 7/64
RPS6	2 9/32	1/2	3/16	13/32	1 25/64
RPS7	2 25/32	1/2	3/16	13/32	1 41/64

Pilot Bushes

Drill Bushes for initial drilling operations





VOLUME DISCOUNT

KEY FEATURES
- Standard OD Sizes
- Special Pilot Hole Bores
- Can be used with Handles, Egg Cups and with Liners

APPLICATION
Boneham Pilot Bushes are designed for guiding drills for pilot holes in drilling and reaming operations. They are traditionally used with liner bushes in a fixture, but they can also be used with handle bushes and egg cup stands. Standard OD's.

ORDERING INSTRUCTIONS
When ordering: Identify the OD of the bush required. The OD will either suit the liner or the hand held fixture used in the application.
For example: 12mm ID Liner
Choose SFM122035

NOTES
Specials Manufactured by BONEHAM

INCH

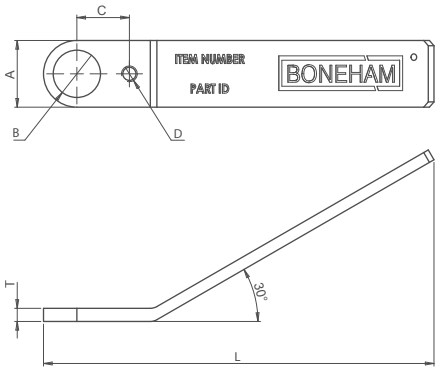
Part Code	ID (A) F7	OD (B) h5		Length	D	E	H	F
RPS21834	1/8"	1/2"	.4997 / .5000	3/4"	51/64"	1/4"	5/8"	1/8"
RPS3516134	5/16"	3/4"	.7496 / .7500	1+3/4"	1-3/64"	1/4"	3/4"	1/8"

METRIC

Part Code	ID (A) F7	OD (B) m6	Length	D	E	H	F
RDP12E35	3.5mm	12mm	20	22	8	16	4
RDP12E45	4.5mm	12mm	20	22	8	16	4
RDP15F65	6.5mm	15mm	28	26	8	18	4
RDP18F80	8mm	18mm	28	30	8	20	4

Handle Bush

Spoon Handle Drill Bush



VOLUME DISCOUNT

KEY FEATURES
- Red Anodised Aluminium
- Etched Part Code
- Etched ID Range
- Special Lock Screw Included

APPLICATION
Boneham Handle Bushes are designed to provide an accurate drilling tool without the need for a rigid fixture. Handle bushes are lightweight, ergonomic and able to provide precise drilling in hard to reach applications.

For applications in fixtures where multi drilling or reaming operations are required, liner bush can be placed in a complex fixture and each handle can be equipped with a pilot and multiple sizes of RD, RPS, SF and SFM bushes using standard renewable bushes and lock-screw assembly. Handle bushes are a must have solution for controlled environments. Kits of bushes can be associated with one handle to reduce error and prevent loss.

Boneham Handle Bushes use renewable RD and RPS bushes to reduce tooling costs across a wide range of tooling, including conventional jigs, handles and egg cup style fixtures.

ORDERING INSTRUCTIONS
When ordering identify the OD size required based on the standard drill range.

Ordering example:
- Handle Only: To Suit 10mm OD bush would be HBM-10
- With Drill Bush: To Suit 10mm OD bush with 6mm bore would be HBM-10 - RD10H 6mm

INCH

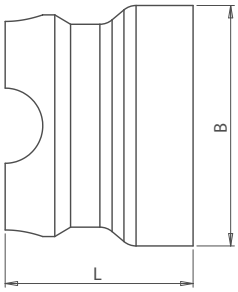
Part No.	B	A	L	T	BS/Din Bushes	ANSI Bush	Lock screw
HB-12-SL	3/16	5/8"	4.75"	0.1968"	-	SF-12	HBLS0
HB-12	3/16	1"	4.75"	0.1968"	-	SF-12	HBLS0
HB-20-SL	5/16	5/8"	4.75"	0.1968"	RPS1	SF-20	HBLS1
HB-20	5/16	1"	4.75"	0.1968"	RPS1	SF-20	HBLS1
HB-32	1/2	1"	4.75"	0.1968"	RPS2	SF-32	HBLS1
HB-48	3/4	1"	4.75"	0.1968"	RPS3	SF-48	HBLS1

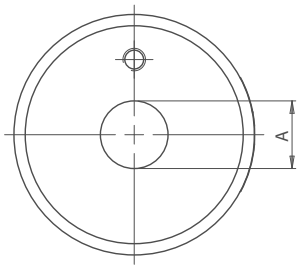
METRIC

Part No.	B	A	L	T	BS/Din Bushes	ANSI Bush	Lock screw
HBM-8-SL	8mm	16mm	4.75"	5mm	RD8	SFM-8	HBMS5
HBM-8	8mm	25mm	4.75"	5mm	RD8	SFM-8	HBMS5
HBM-10-SL	10mm	16mm	4.75"	5mm	RD10	SFM-10	HBMS5
HBM-10	10mm	25mm	4.75"	5mm	RD10	SFM-10	HBMS5
HBM-12	12mm	25mm	4.75"	5mm	RD12	SFM-12	HBMS6
HBM-15	15mm	25mm	4.75"	5mm	RD15	SFM-15	HBMS6
HBM-18	18mm	25mm	4.75"	5mm	RD18	SFM-18	HBMS6

Egg Cup Bush

Right Angle Drill Bush Fixture





VOLUME DISCOUNT

KEY FEATURES
/ Ideal for drilling sheet metal
/ Red Anodised Aluminium
/ For Standard Renewable Bushes
/ Etched Part Code
/ Etched Size Range

APPLICATION
Boneham "Egg Cup" style drill bush fixtures are designed to provide an accurate and portable drilling fixture. This drilling solution is ideal for sheet metal applications including piloting, drilling and reaming for rivets. Interchangeable with traditional Boneham drill bushes and lock screws. No need for a separate range of drill bushes or liners.

ORDERING INSTRUCTIONS
When ordering identify the OD size required based on the standard drill range.
For example:
/ 1/4" drilled hole: RPS2 1/4" x 3/4" bush required and an Egg Cup part of ECB-500

NOTES
/ Nylon version available
/ Specials Manufactured by BONEHAM

INCH

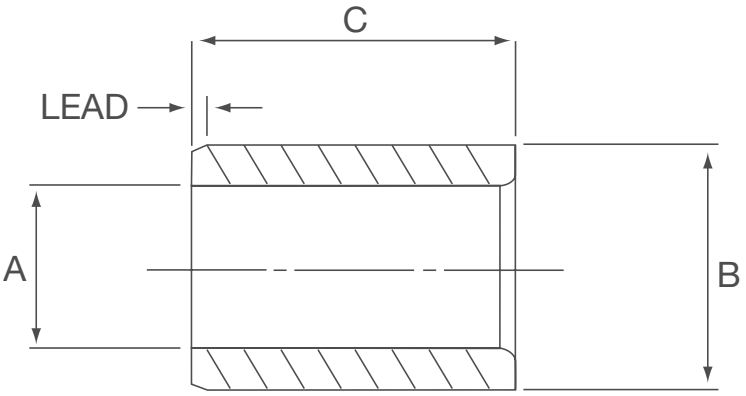
Part Code	Fixture ID (A)	To Suit Bush ID Range	Diameter (B)	Height (L)
ECB-500	0.500"	5/32" - 11/32"	64mm	50mm

METRIC

Part Code	Fixture ID (A)	To Suit Bush ID Range	Diameter (B)	Height (L)
ECB-8	8mm	1mm - 4mm	64mm	50mm
ECB-10	10mm	3.7mm - 6mm	64mm	50mm
ECB-12	12mm	5.7mm - 8mm	64mm	50mm
ECB-15	15mm	7.7mm - 10mm	64mm	50mm
ECB-18	18mm	9.6mm - 12mm	64mm	50mm

Liner Drill Bushes – Plain

BS 1098 PT.2 1977/ISO 4247/DIN 179A



HUGE STOCKS

VOLUME DISCOUNT

ORDERING INSTRUCTIONS
/ State: Qty and Ref.
/ 5, LP48J.

FITTING INSTRUCTIONS
Bore or Ream to dimension 'B' H6 limits when bush will be suitable press fit.

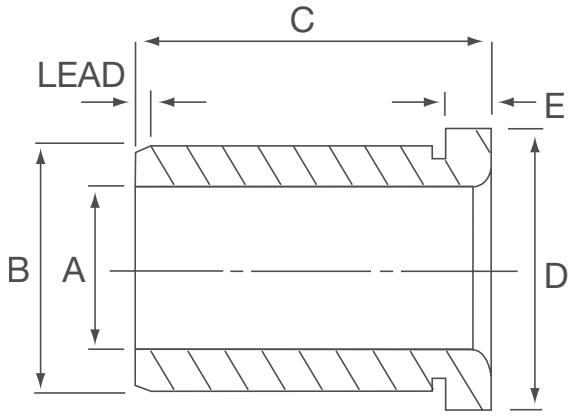
NOTES
See page 33 for table showing ISO limits for liner bushes.
/ Bushes with a bore size above 62mm may not be stock items. These bushes are manufactured against customer's order only.

A Dia. F7 Limits	B Dia. n6 Limits	Length C and Bush Reference					
		Short		Long		Extra Long	
		C	Ref.	C	Ref.	C	Ref.
8	12	10	LP12D	16	LP12F	-	-
10	15	12	LP15E	20	LP15H	25	LP15J
12	18	12	LP18E	20	LP18H	25	LP18J
15	22	16	LP22F	28	LP22K	36	LP22N
18	26	16	LP26F	28	LP26K	36	LP26N
22	30	20	LP30H	36	LP30N	45	LP30R
26	35	20	LP35H	36	LP35N	45	LP35R
30	42	25	LP42J	45	LP42R	56	LP42S
35	48	25	LP48J	45	LP48R	56	LP48S
42	55	30	LP55L	56	LP55S	67	LP55T
48	62	30	LP62L	56	LP62S	67	LP62T
55	70	30	LP70L	56	LP70S	67	LP70T
62	78	35	LP78M	67	LP78T	78	LP78W
70	85	35	LP85M	67	LP85T	78	LP85W
78	95	40	LP95P	78	LP95W	105	LP95Y
85	105	40	LP105P	78	LP105W	105	LP105Y
95	115	45	LP115R	89	LP115X	112	LP115Z
105	125	45	LP125R	89	LP125X	112	LP125Z

All dimensions in millimetres

Liner Bushes – Headed

BS 1098 PT.2 1977/ISO 4247/DIN 172A



HUGE STOCKS

VOLUME DISCOUNT

ORDERING INSTRUCTIONS
/ State: Qty and Ref.
/ Example – 5, LH42J

FITTING INSTRUCTIONS
Bore or Ream to dimension 'B' H6 limits when bush will be suitable press fit.

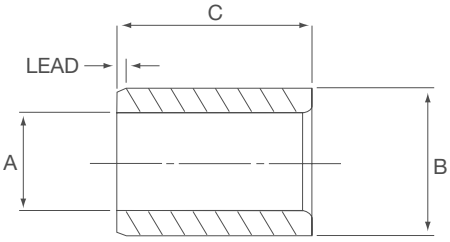
NOTES
See page 33 for table showing ISO limits for liner bushes.
/ Bushes with a bore size above 62mm may not be stock items. These bushes are manufactured against customer's order only.

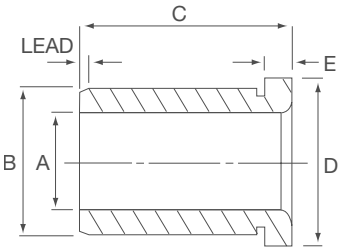
A Dia. F7 Limits	B Dia. n6 Limits	Length C and Bush Reference						D Dia. h13 Limits	E Length
		Short		Long		Extra Long			
		C	Ref.	C	Ref.	C	Ref.		
8	12	10	LH12D	16	LH12F	-	-	15	3
10	15	12	LH15E	20	LH15H	25	LH15J	18	3
12	18	12	LH18E	20	LH18H	25	LH18J	22	4
15	22	16	LH22F	28	LH22K	36	LH22N	26	4
18	26	16	LH26F	28	LH26K	36	LH26N	30	4
22	30	20	LH30H	36	LH30N	45	LH30R	34	5
26	35	20	LH35H	36	LH35N	45	LH35R	39	5
30	42	25	LH42J	45	LH42R	56	LH42S	46	5
35	48	25	LH48J	45	LH48R	56	LH48S	52	5
42	55	30	LH55L	56	LH55S	67	LH55T	59	5
48	62	30	LH62L	56	LH62S	67	LH62T	66	6
55	70	30	LH70L	56	LH70S	67	LH70T	74	6
62	78	35	LH78M	67	LH78T	78	LH78W	82	6
70	85	35	LH85M	67	LH85T	78	LH85W	90	6
78	95	40	LH95P	78	LH95W	105	LH95Y	100	6
85	105	40	LH105P	78	LH105W	105	LH105Y	110	6
95	115	45	LH115R	89	LH115X	112	LH115Z	120	6
105	125	45	LH125R	89	LH125X	112	LH125Z	130	6

All dimensions in millimetres

Liner Drill Bushes

BS 1098 PT.1 1967





HUGE STOCKS

VOLUME DISCOUNT

ORDERING INSTRUCTIONS
/ State: Ref. and Length

Oversize bushes: +,010"/+.015" on 'B' diameter can be supplied for finish grinding. State O/S if required after ref.

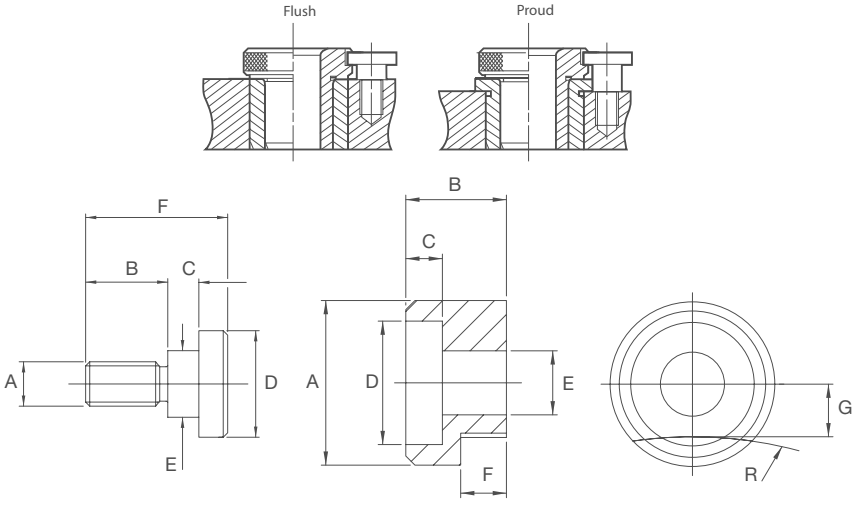
A Dia. Size	A Dia. Limit	B Dim.	Length C and Reference 5/16"	3/8"	1/2"	3/4"	1"	1 1/4"	1 3/8"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"
5/16	+.0002 +.0004	.5006 .5010	PL1	PL1	PL1	PL1	PL1							
1/2	+.0002 +.0006	.7507 .7512	PL2	PL2	PL2	PL2	PL2	PL2						
3/4	+.0003 +.0006	1.0009 1.0015			PL3	PL3	PL3	PL3		PL3				
1	+.0003 +.0006	1.3759 1.3765				PL4	PL4	PL4	PL4	PL4	PL4	PL4		
1 3/8	+.0004 +.0008	1.7510 1.7517				PL5	PL5	PL5	PL5	PL5	PL5	PL5	PL5	
1 3/4	+.0004 +.0008	2.2512 2.2520					PL6	PL6	PL6	PL6	PL6	PL6	PL6	PL6
2 1/4	+.0004 +.0009	2.7512 2.7520					PL7	PL7	PL7	PL7	PL7	PL7		PL7

A Dia. Size	A Dia. Limit	B Dim.	Length C and Reference 5/16"	3/8"	1/2"	3/4"	1"	1 1/4"	1 3/8"	1 1/2"	1 3/4"	2"	2 1/4"	2 1/2"	Head D	Head E
5/16	+.0002 +.0004	.5006 .5010	SL1	SL1	SL1	SL1	SL1								5/8	1/8
1/2	+.0002 +.0006	.7507 .7512	SL2	SL2	SL2	SL2	SL2	SL2							7/8	1/8
3/4	+.0003 +.0006	1.0009 1.0015			SL3	SL3	SL3	SL3		SL3					1 1/8	1/8
1	+.0003 +.0006	1.3759 1.3765				SL4	SL4	SL4	SL4	SL4	SL4	SL4			1 1/2	1/8
1 3/8	+.0004 +.0008	1.7510 1.7517				SL5	SL5	SL5	SL5	SL5	SL5	SL5	SL5		1 7/8	1/8
1 3/4	+.0004 +.0008	2.2512 2.2520					SL6	SL6	SL6	SL6	SL6	SL6	SL6	SL6	2 3/8	1/8
2 1/4	+.0004 +.0009	2.7512 2.7520					SL7	SL7	SL7	SL7	SL7	SL7		SL7	2 7/8	1/8

References shaded price on application

Lock Screw

BS 1098 PT.2 1977/ISO 4247



WHEN BUSH HEAD IS FLUSH

For use with Bushes	F	C	B	D	E	A	Screw Ref.
RD8 - RD10	15	3	9	13	7.5	M5	MS5
RD12 - RD18	18	4	10	16	9.5	M6	MS6
RD22 - RD42	22	5.5	11.5	20	12.0	M8	MS8
RD4S - RD105	32	7	18.5	24	15.0	M10	MS10

WHEN BUSH HEAD IS PROUD

For use with Bushes	F	C	B	D	E	A	Screw Ref.
RD8 - RD10	18	6	9	13	7.5	M5	LMS5
RD12 - RD18	22	8	10	16	9.5	M6	LMS6
RD22 - RD42	27	10.5	11.5	20	12.0	M8	LMS8
RD48 - RD105	38	13	18.5	24	15.0	M10	LMS10

All dimensions in millimetres

TENONS

WHEN BUSH HEAD IS FLUSH

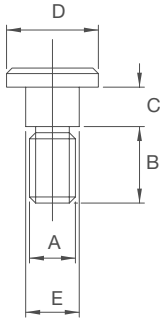
For use with Bushes	B	F	C	A	D	E	R	G	Size of Fixing Screw	Tenon Ref.
RD8 - RD10	8	3	4	13	10	5.1	9.5	3.7	M5	DMS5
RD12 - RD18	10	4	5	16	12	6.1	15	4.7	M6	DMS6
RD22 - RD42	12	5.5	5	20	15	8.1	30	6.2	M8	DMS8
RD48 - RD105	16	7	7	24	18	10.1	80	7.5	M10	DMS10

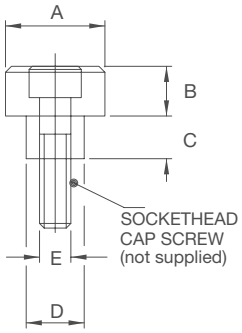
WHEN BUSH HEAD IS PROUD

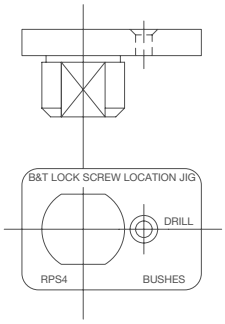
For use with Bushes	B	F	C	A	D	E	R	G	Size of Fixing Screw	Tenon Ref.
RD8 - RD10	11	6	4	13	10	5.1	9.5	3.7	M5	DLMS5
RD12 - RD18	14	8	5	16	12	6.1	15	4.7	M6	DLMS6
RD22 - RD42	17	10.5	5	20	15	8.1	30	6.2	M8	DLMS8
RD48 - RD105	22	13	7	24	18	10.1	80	7.5	M10	DLMS10

All dimensions in millimetres

Lock Screws







HUGE STOCKS

VOLUME DISCOUNT

ORDERING INSTRUCTIONS
/ State: Qty, Ref. and Thread.

NOTES
These detachable lock screws consist of a separate hardened bush held in place by a socket head screw, because of this they are easier to fit and replace than the solid conventional type lock screw listed above. Further, the hardened bush can be held against the slip bush and used as a simple jig for locating the screw.

These jigs locate the lock screw position accurately and quickly. The spigot fits a bore the same inside diameter as the corresponding liner.

B&T Ref.	A		B	C	D	E		To suit Bushes Nos.
LSA	5/16”	BSF UNC Whit	3/8”	.135”	5/8”	3/8”	For use when Flush Fitting Liner is used.	RPS1 to RPS5
LSC	3/8”	BSF UNC Whit	5/8”	.197”	3/4”	7/16”	For use when Flush Fitting Liner is used.	RPS6 and RPS7
LSD	5/16”	BSF UNC Whit	3/8”	.260”	5/8”	3/8”	For use when Headed type Liner is used with Head Proud.	RPS1 to RPS5
LSF	3/8”	BSF UNC Whit	5/8”	.322”	3/4”	7/16”	For use when Headed type Liner is used with Head Proud.	RPS 6 and RPS7

DETACHABLE LOCK SCREWS

B&T Ref	A	B	C	D	E		To suit Bushes Nos.
DLSA	5/8”	5/16”	.135”	3/8”	2 BA	For use when Flush Fitting Liner is used.	RPS1 to RPS5
DLSC	3/4”	3/8”	.197”	7/16”	1/4” Whit	For use when Flush Fitting Liner is used.	RPS6 and RPS7
DLSD	5/8”	5/16”	.260”	3/8”	2 BA	For use when Headed type Liner is used with Head Proud.	RPS1 to RPS5
DLSF	3/4”	3/8”	.322”	7/16”	1/4” Whit	For use when Headed type Liner is used with Head Proud.	RPS 6 and RPS7

LOCK SCREW LOCATING JIG

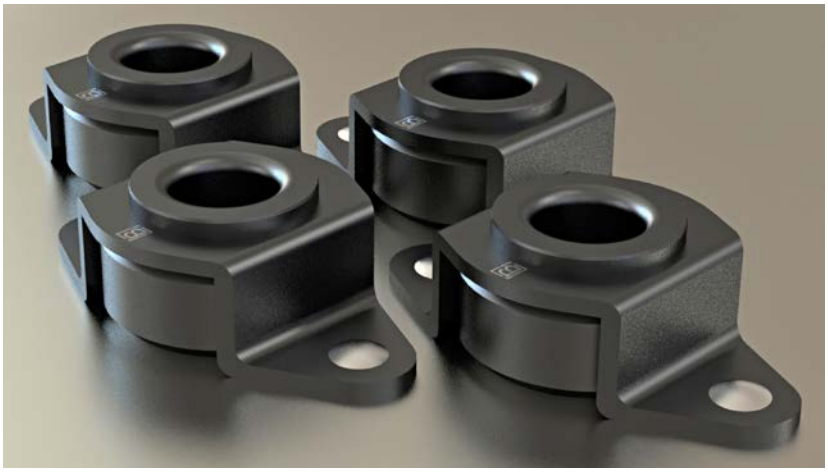
Jig Ref.	LJ1	LJ2	LJ3	LJ4	LJ5	LJ6	LJ7
Suitable for Bushes	RPS1	RPS2	RPS3	RPS4	RPS5	RPS6	RPS7

Imperial and Metric Bore Sizes

Decimal Equivalents for Imperial Range BS 1098 PT1 1967
and Metric Sizes for Metric Range ISO 4247

Dec. Equiv.	Eng.	m/m	Dec. Equiv.	Eng.	m/m	Dec. Equiv.	Eng.	m/m	Dec. Equiv.	Eng.	m/m	Dec. Equiv.	Eng.	m/m	Dec. Equiv.	Eng.	m/m	Dec. Equiv.	Eng	m/m
.0469	3/64		.1299		3.3	.2559		6.5	.3819		9.7	.5079		12.9	.8268		21.00	1.2205		31.00
.0472		1.2	.1339		3.4	.2598		6.6	.3839		9.75	.5118		13.00	.8366		21.25	1.2303		31.25
.0492		1.25	.1378		3.5	.2638		6.7	.3858		9.8	.5157		13.1	.8465		21.50	1.2402		31.50
.0512		1.3	.1406	9/64		.2656	17/64		.3898		9.9	.5197		13.2	.8563		21.75	1.250	11/4	
.0532		1.35	.1417		3.6	.2657		6.75	.3906	25/64		.5217		13.25	.8661		22.00	1.2598		32.00
.0551		1.4	.1457		3.7	.2677		6.8	.3937		10.00	.5236		13.3	.8750	7/8		1.2697		32.25
.0571		1.45	.1476		3.75	.2717		6.9	.3976		10.1	.5276		13.4	.8760		22.25	1.2795		32.50
.0591		1.5	.1496		3.8	.2756		7.00	.4016		10.2	.5315		13.5	.8858		22.50	1.2894		32.75
.0610		1.55	.1535		3.9	.2795		7.1	.4035		10.25	.5354		13.6	.8957		22.75	1.2992		33.00
.0625	1/16		.1562	5/32		.2812	9/32		.4055		10.3	.5394		13.7	.9055		23.00	1.3125	15/16	
.0630		1.6	.1575		4.0	.2835		7.2	.4062	13/32		.5413		13.75	.9154		23.25	1.3189		33.50
.0650		1.65	.1614		4.1	.2854		7.25	.4094		10.4	.5433		13.8	.9252		23.50	1.3386		34.00
.0669		1.7	.1654		4.2	.2874		7.3	.4134		10.5	.5472		13.9	.9350		23.75	1.3583		34.50
.0689		1.75	.1673		4.25	.2913		7.4	.4173		10.6	.5512		14.00	.9375	15/16		1.3750	13/8	
.0709		1.8	.1693		4.3	.2953		7.5	.4213		10.7	.5610		14.25	.9449		24.00	1.3780		35.00
.0728		1.85	.1719	11/64		.2969	19/64		.4219	27/64		.5625	9/16		.9547		24.25	1.3976		35.50
.0748		1.9	.1732		4.4	.2992		7.6	.4232		10.75	.5709		14.5	.9646		24.50	1.4173		36.00
.0768		1.95	.1772		4.5	.3032		7.7	.4252		10.8	.5807		14.75	.9744		24.75	1.4370		36.50
.0781	5/64		.1811		4.6	.3051		7.75	.4291		10.9	.5906		15.00	.9843		25.00	1.4375	17/16	
.0787		2.00	.1850		4.7	.3071		7.8	.4331		11.00	.6004		15.25	.9941		25.25	1.4567		37.00
.0807		2.05	.1870		4.75	.3110		7.9	.4370		11.1	.6102		15.5	1.000	1		1.4764		37.50
.0827		2.1	.1875	3/16		.3125	5/16		.4375	7/16		.6201		15.75	1.0039		25.50	1.4961		38.00
.0846		2.15	.1890		4.8	.3150		8.00	.4409		11.2	.6250	5/8		1.0138		25.75	1.5000	11/2	
.0866		2.2	.1929		4.9	.3189		8.1	.4429		11.25	.6299		16.00	1.0236		26.00	1.5157		38.50
.0886		2.25	.1968		5.00	.3228		8.2	.4449		11.3	.6398		16.25	1.0335		26.25	1.5354		39.00
.0906		2.3	.2008		5.1	.3248		8.25	.4488		11.4	.6496		16.5	1.0433		26.50	1.5551		39.50
.0925		2.35	.2031	13/64		.3268	21/64	8.3	.4528		11.5	.6594		16.75	1.0531		26.75	1.5625	19/16	
.0938	3/32		.2047		5.2	.3281			.4531	29/64		.6693		17.00	1.0625	11/16		1.5748		40.00
.0945		2.4	.2067		5.25	.3307		8.4	.4567		11.6	.6791		17.25	1.0630		27.00	1.5945		40.50
.0965		2.45	.2087		5.3	.3346		8.5	.4606		11.7	.6875	11/16		1.0728		27.25	1.6142		41.00
.0984		2.5	.2126		5.4	.3386		8.6	.4626		11.75	.6890		17.5	1.0827		27.50	1.6250	15/8	
.1004		2.55	.2165		5.5	.3425		8.7	.4646		11.8	.6988		17.75	1.0925		27.75	1.6339		41.50
.1024		2.6	.2188	7/32		.3438	11/32		.4685		11.9	.7087		18.00	1.1024		28.00	1.6535		42.00
.1043		2.65	.2205		5.6	.3445		8.75	.4688	15/32		.7185		18.25	1.1122		28.25	1.6732		42.50
.1063		2.7	.2244		5.7	.3465		8.8	.4724		12.00	.7283		18.5	1.1220		28.50	1.6875	111/16	
.1083		2.75	.2264		5.75	.3504		8.9	.4764		12.1	.7382		18.75	1.1250	11/8		1.6929		43.00
.1094	7/64		.2283		5.8	.3543		9.00	.4803		12.2	.7480		19.00	1.1319		28.75	1.7126		43.50
.1102		2.8	.2323		5.9	.3583		9.1	.4823		12.25	.7500	3/4		1.1417		29.00	1.7323		44.00
.1122		2.85	.2344	15/64		.3594	23/64		.4843		12.3	.7579		19.25	1.1516		29.25	1.750	13/4	
.1142		2.9	.2362		6.00	.3622		9.2	.4844	31/64		.7677		19.5	1.1614		29.50	1.7520		44.50
.1161		2.95	.2402		6.1	.3642		9.25	.4882		12.4	.7776		19.75	1.1713		29.75	1.7717		45.00
.1181		3.00	.2441		6.2	.3661		9.3	.4921		12.5	.7874		20.00	1.1811		30.00	1.7913		45.50
.1220		3.1	.2461		6.25	.3701		9.4	.4961		12.6	.7972		20.25	1.1875	13/16		1.8110		46.00
.1250	1/8		.2480		6.3	.3740		9.5	.5000	1/2	12.7	.8071		20.5	1.1909		30.25	1.8307		46.50
.1260		3.2	.2500	1/4		.3750	3/8		.5020		12.75	.8125	13/16		1.2008		30.50	1.8504		47.00
.1280		3.25	.2520		6.4	.3780		9.6	.5039		12.8	.8169		20.75	1.2106		30.75	1.8701		47.50
																		1.8898		48.00

Anchor Bushes



HUGE STOCKS

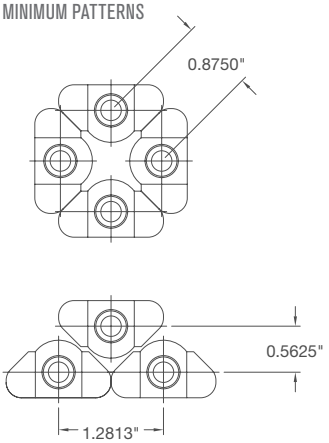
VOLUME DISCOUNT

The B&T Anchor Bush is a two-piece assembly consisting of a hardened steel bush with a bore to suit the appropriate drill size and a low carbon steel anchor which is either welded or riveted to the drill template. This strap only holds the bush firmly in place and has no influence on location which is obtained from a spigot on the bush machined concentric with the bore. Thus Anchor Bushes can be spaced accurately, when desired, by Jig Boring the template. On many applications, however, marking out and either punching or drilling the locating holes is sufficiently accurate. B&T Anchor Bushes are made in Standard and Corner types and by using a combination of the two various hole patterns can be made up as shown on the following pages.

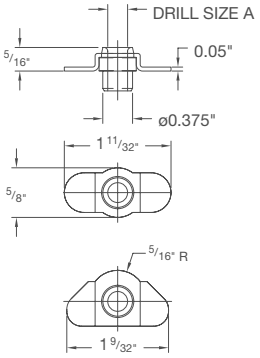
AB1

A Bore	C O.D.	B Length
3/64" to 9/32"	.375" +.000" -.004"	.050"
		.125"
1.2mm to 7.1mm		.187"
		.250"
		.375"

MINIMUM PATTERNS



Standard Type Ref. AB1

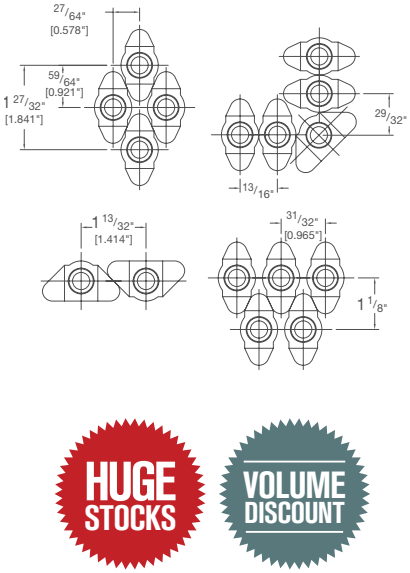


Anchor Bushes

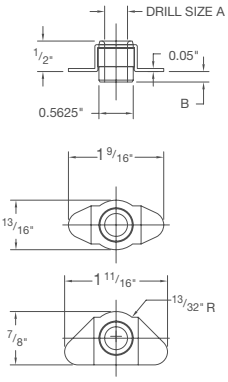
AB2

A Bore	C O.D.	B Length
9/32" to 29/64"	.5625" +.000" -.004"	.050"
		.125"
7.2mm to 11.5mm		.187"
		.250"
		.375"

MINIMUM PATTERNS



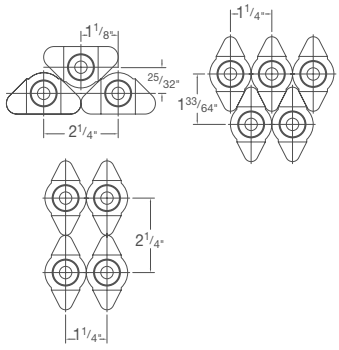
Standard Type Ref. AB2



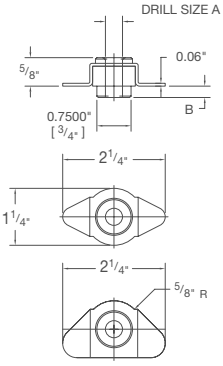
AB3

A Bore	C O.D.	B Length
29/64" to 5/8"	.750" +.000" -.004"	.050"
		.125"
11.6mm to 15.75mm		.187"
		.250"
		.375"

MINIMUM PATTERNS



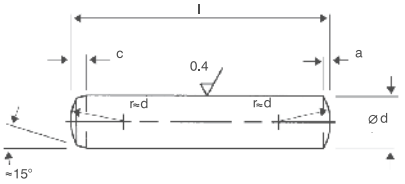
Standard Type Ref. AB3



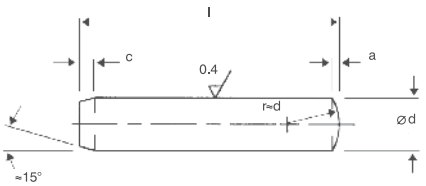
Dowel Pins Plain – Metric

BS 8734 (1992) / ISO 8734 Limits, Types A & B including additional lengths

Type A
Through hardened steel



Type B
Hardened Steel. Except 1mm to 3mm unhardened.



1mm to 3mm dia Pins can be supplied hardened specially.

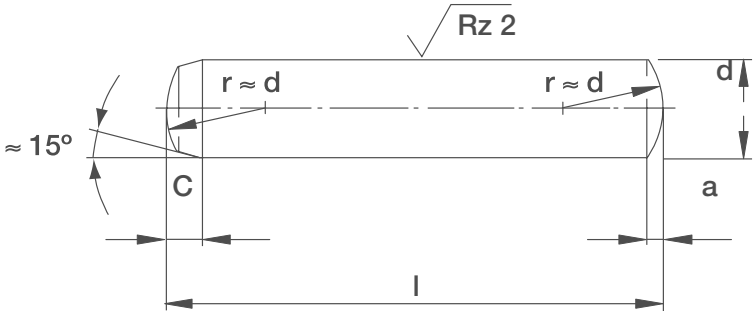
Our stock is based on Type B Pins

d= m6 limit mm			+.002 +.009	+.002 +.009	+.002 +.009	+.002 +.009	+.002 +.009	+.004 +.012	+.004 +.012	+.004 +.012	+.006 +.015	+.006 +.015	+.007 +.018	+.007 +.018	+.008 +.021	+.008 +.021
l min	l max	d l	1	1.5	2	2.5	3	4	5	6	8	10	12	16	20	25
2.75	3.25	3														
3.75	4.25	4														
4.75	5.25	5														
5.75	6.25	6														
7.75	8.25	8														
9.75	10.25	10														
11.5	12.5	12														
13.5	14.5	14														
15.5	16.5	16														
17.5	18.5	18														
19.5	20.5	20														
21.5	22.5	22														
23.5	24.5	24														
24.5	25.5	25														
25.5	26.5	26														
27.5	28.5	28														
29.5	30.5	30														
31.5	32.5	32														
34.5	35.5	35														
39.5	40.5	40														
44.5	45.5	45														
49.5	50.5	50														
54.25	55.75	55														
59.25	60.75	60														
64.25	65.75	65														
69.25	70.75	70														
74.25	75.75	75														
79.25	80.75	80														
84.25	85.75	85														
89.25	90.75	90														
94.25	95.75	95														
99.25	100.75	100														
109.25	110.75	110														
119.25	120.75	120														

Dowel Pins can be supplied with air release flat at extra cost

Dowel Pin

DIN 6325



HUGE STOCKS

VOLUME DISCOUNT

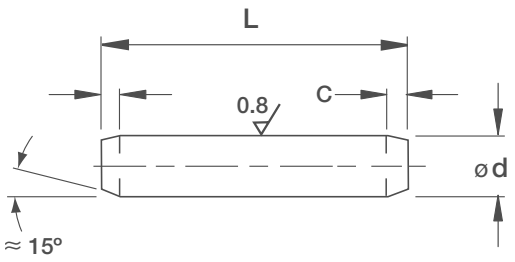
- Fully hardened and tempered, fine ground finished to m6, turned tip and edge.
- Hardness: 60 ± 2 HRC

ORDERING INSTRUCTIONS
- State: Diameter and Length

d		m6	1	1.5	2	2.5	3	4	5	6	8	10	12	16	20
a		≈	0.12	0.20	0.25	0.3	0.4	0.5	0.63	0.8	1	1.2	1.6	2	2.5
c			0.5	0.6	0.8	1	1.2	1.4	1.7	2.1	2.6	3	3.8	4.6	6
r1		min	-	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.6	0.8	0.8
		max	-	0.6	0.6	0.7	0.8	0.9	1	1.1	1.3	1.4	1.6	1.8	2
Nominal	l														
Value	min	max													
4	3.75	4.25													
5	4.75	5.25													
6	5.75	6.25													
8	7.75	8.25													
10	9.75	10.25													
12	11.50	12.50													
14	13.50	14.50													
16	15.50	16.50													
18	17.50	18.50													
20	19.50	20.50													
24	23.50	24.50													
28	27.50	28.50													
32	31.50	32.50													
35	34.50	35.50													
40	39.50	40.50													
45	44.50	45.50													
50	49.50	50.50													
55	54.25	55.75													
60	59.25	60.75													
70	69.25	70.75													
80	79.25	80.75													
90	89.25	90.75													
100	99.25	100.75													
120	119.25	120.75													

Dowel Pins Stainless Steel – Metric & Imperial

ISO 2338A Stainless Steel A2



HUGE STOCKS · VOLUME DISCOUNT · STAINLESS STEEL

MATERIAL: Stainless Steel A2 Soft Condition. d = m6 Limit.
TO ORDER: State DP55 d x L

L \ d	c	1mm	1.5mm	2mm	2.5mm	3mm	4mm	5mm	6mm	8mm	10mm	12mm	16mm
		0.2	0.3	0.35	0.4	0.5	0.63	0.8	1.2	1.6	2	2.5	3
5													
8													
10													
12													
16													
20													
24													
30													
35													
36													
40													
45													
50													
60													
80													
100													
120													

Other sizes available.

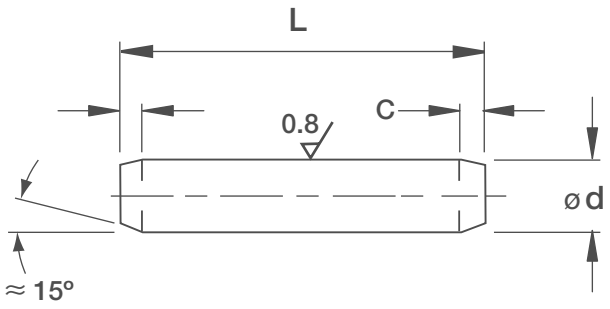
IMPERIAL SIZES

MATERIAL: Stainless Steel A2 Soft Condition. d = m6 Limit.
TO ORDER: State DP66 d x L

L \ d	c	1/16	3/32	1/8	3/16	1/4	5/16
		0.020	0.020	0.020	0.030	0.030	0.040
1/4							
3/8							
1/2							
5/8							
3/4							
1							
1 1/4							
1 1/2							
1 3/4							
2							

Dowel Pins Stainless Steel – Metric

ISO 2338A Stainless Steel 316



HUGE STOCKS

VOLUME DISCOUNT

STAINLESS STEEL

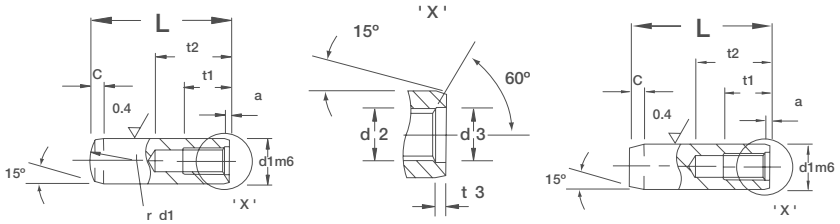
MATERIAL: Stainless Steel 316 Soft Condition. d = m6 Limit.
TO ORDER: State DP88 d x L

L	d / c	1mm 0.2	1.5mm 0.3	2mm 0.35	2.5mm 0.4	3mm 0.5	4mm 0.63	5mm 0.8	6mm 1.2	8mm 1.6	10mm 2	12mm 2.5	16mm 3
5													
8													
10													
12													
16													
20													
24													
30													
35													
36													
40													
45													
50													
60													
80													
100													
120													

Other sizes available.

Dowel Pins Tapped – Metric

BS 8735 / ISO 8735 Limits, Types A and B



Our stock is based on Type B Pins

d^1		6	8	10	12	16	20	25	30	40	50
d=	m6 Limits	+.004 +.012	+.006 +.015	+.006 +.015	+.007 +.018	+.007 +.018	+.008 +.021	+.008 +.021			
a	≈	0.8	1	1.2	1.6	2	2.5	3	4	5	6.3
c		2.1	2.6	3	3.8	4.6	6	6	7	8	10
d^2		M3*	M4*	M6	M6	M8	M10	M16	M20	M20	M24
d^3		4.3	5.3	6.4	6.4	8.4	10.5	17	21	21	25
t^1		6	8	10	12	16	18	24	30	30	36
t^2	min.	10	12	16	20	25	28	35	40	40	50
t^3		1	1.2	1.2	1.2	1.5	1.5	2	2	2.5	2.5
L nom.	L min.	L max.									
16	15.5	16.5									
18	17.5	18.5									
20	19.5	20.5									
22	21.5	22.5									
24	23.5	24.5									
25	24.5	25.5									
28	27.5	28.5									
30	29.5	30.5									
32	31.5	32.5									
35	34.5	35.5									
40	39.5	40.5									
45	44.5	45.5									
50	49.5	50.5									
55	54.25	55.75									
60	59.25	60.75									
65	64.25	65.75									
70	69.25	70.75									
75	74.25	75.75									
80	79.25	80.75									
85	84.25	85.75									
90	89.25	90.75									
95	94.25	95.75									
100	99.25	100.75									
120	119.25	120.75									
140	139.25	140.75									
160	159.25	160.75									
180	179.25	180.75									
200	199.25	200.75									

HUGE STOCKS

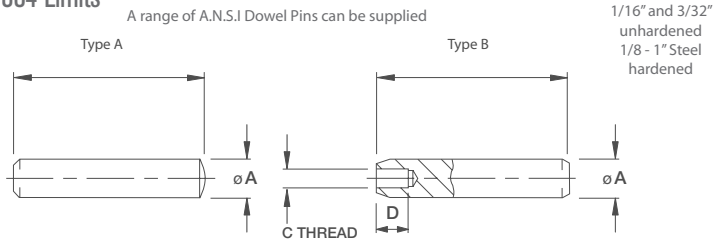
VOLUME DISCOUNT

/ d2* to prevent cracking B&T supply 6mm and 8mm pins with smaller tapped hole size than the BS/ISO standard.
/ Tapped Dowel Pin Extractors available – state thread size. Dowel Pins can be supplied with air release flat at extra cost.

Dowel Pins Plain and Tapped – Imperial

Plain BS 1804 Limits

A range of A.N.S.I Dowel Pins can be supplied



1/16" and 3/32" unhardened 1/8 - 1" Steel hardened

/ 1/16" and 3/32" dia Pins can be supplied hardened specially.
/ Diam's 1/16" - 3/32" - 1/8" will be chamfered each end.

T = Tapped range

Diameter 'A'		1/16"	3/32"	1/8"	5/32"	3/16"	7/32"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
'C' thread								4 B.A.	3 B.A.	2 B.A.	1/4" B.S.F.	1/4" B.S.F.	1/4" B.S.F.	
	'D'							1/4"	1/4"	5/16"	3/8"	3/8"	3/8"	
'B' Length	1/4"													
	5/16"													
	3/8"													
	7/16"													
	1/2"							T	T	T				
	9/16"													
	5/8"							T	T	T				
	3/4"							T	T	T	T			
	7/8"							T	T	T	T			
	1"							T	T	T	T	T		
	1 1/8"							T	T	T	T	T		
	1 1/4"							T	T	T	T	T		
	1 3/8"							T	T	T	T	T		
	1 1/2"							T	T	T	T	T	T	
	1 5/8"							T	T	T	T	T		
	1 3/4"							T	T	T	T	T	T	
	1 7/8"							T	T	T	T	T		
	2"							T	T	T	T	T	T	
	2 1/8"							T	T	T	T	T	T	
	2 1/4"							T	T	T	T	T	T	
	2 3/8"							T	T	T	T	T	T	
	2 1/2"							T	T	T	T	T	T	
	2 5/8"								T	T	T	T		
	2 3/4"							T	T	T	T	T	T	
	2 7/8"								T	T	T	T	T	
	3"							T	T	T	T	T	T	
	3 1/8"								T	T	T			
	3 1/4"								T	T	T	T	T	
	3 1/2"								T	T	T	T	T	
	3 3/4"									T	T	T	T	
	4"									T	T	T	T	
	4 1/4"											T	T	
	4 1/2"											T	T	
	5"											T	T	
	5 1/4"												T	
	5 1/2"												T	
	6"												T	

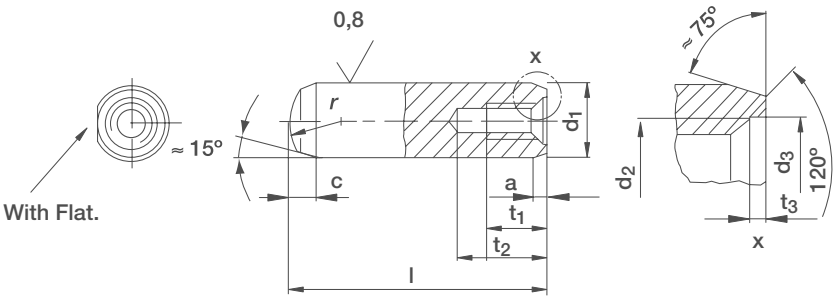
HUGE STOCKS

VOLUME DISCOUNT

/ Intermediate lengths can be supplied to order.
/ Tapped Dowel Pin Extractors available - state thread size. Dowel Pins can be supplied with air release flat at extra cost.

Dowel Pin with Internal Thread

DIN 7979



HUGE STOCKS

VOLUME DISCOUNT

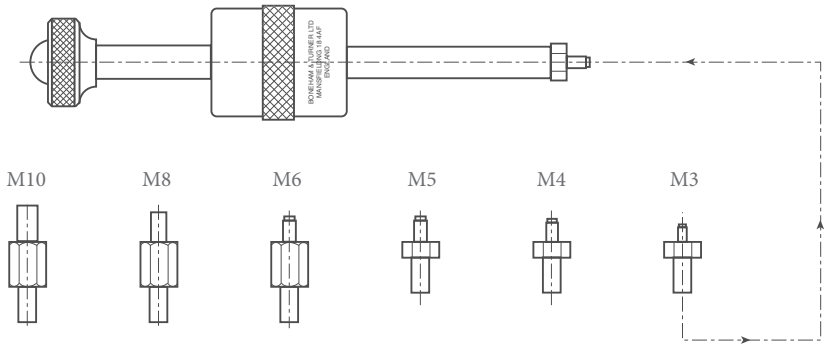
- Hardened, tempered and fine ground finished to ISO tolerance m6 with air-vent flat.
- Hardness: 600 - 700 HV1

ORDERING INSTRUCTIONS

- State: Diameter and Length

d1 m6	6	8	10	12	16	20
r	6	8	10	12	16	20
d2	M 4	M 5	M 6	M 6	M 8	M 10
d3	4.3	5.3	6.4	6.4	8.4	10.5
t1	6	8	10	10	12	16
t2 min.	10	12	16	16	20	25
t3	1	1.2	1.2	1.2	1.5	1.5
a	0.8	1.0	1.2	1.6	2.0	2.5
c	2.1	2.6	3.0	3.8	4.6	6.0
Length l						
16						
18						
20						
24						
28						
32						
35						
40						
45						
50						
55						
60						
70						
80						
90						
100						
120						

Tapped Dowel Pin Extractor



VOLUME DISCOUNT

KEY FEATURES
- Metric M3 to M10
- INCH UNC, UNF, BSW and BSF
- Slide hammer style
- Knurled for extra grip
- Special head sizes manufactured

APPLICATION
The Boneham Extractor Tool is designed for use with extractable dowel pins in metric and inch. The tool uses a slide hammer method making it extremely easy to use. Knurled parts allow for easy grip.

ORDERING INSTRUCTIONS
- When ordering the tool state: DPE
- When ordering metric heads state: DPE and then metric size. Example: DPE3MM
- When ordering INCH heads state: DPE, size and standard. Example: DPE3/8BSF

NOTES
- A BONEHAM original product. For Extractable dowel pins see pages 58-59.
- BA, UNC and BSF heads available.
- For metric and imperial full kits, please see the following page.

CODE SUFFIX	UNF / UNC	METRIC
DPE	4-40	M2.5
DPE	8-32	M3
DPE	10-32	M4
DPE	1/4-20	M5
DPE	5/16-18	M6
DPE		M8
DPE		M10
DPE		M12
DPE		M16

Dowel Extractor Kit

DPE and DP Heads

VOLUME DISCOUNT

KEY FEATURES
/ Dowel Pin Extractor Tool
/ Choice of Metric or Inch extractor heads
/ Waterproof and Dustproof case
/ Case certified according to IP67

APPLICATION
The Boneham Dowel Pin Extractor tool is used to extract tapped dowel pins from their location hole. This kit is supplied in a hard, durable and ergonomic case. It's ideal for production environments and tool control. The case uses pick and pluck foam so operators can customise to suit. The case is supplied as pictured.

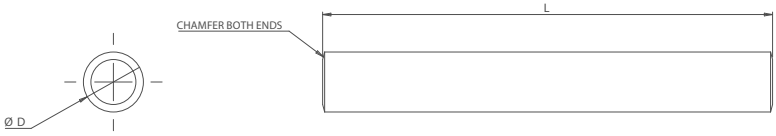
ORDERING INSTRUCTIONS
The Dowel Pin Extractor Kit has a part number of DPE001 for Metric and DPE002 for Inch. Please see table below for the kit contents.

NOTES
Specials Manufactured by BONEHAM

Part Code	Tool	Unit	Heads included						
DPE001	DPE	Metric	M3	M4	M5	M6	M8	M10	M16
DPE002	DPE	Inch	4-40	8-32	10-32	1/4-20	5/16-18		

Nylon Dowel Pins

Nylon 66 Dowel Pins



HUGE STOCKS

NYLON

KEY FEATURES
/ White Nylon 6.6
/ Tough and Rigid
/ Excellent Abrasion and Chemical Resistance
/ Low Friction Coefficient

APPLICATION
Nylon dowels are ideal for the composite mould process. They have a wide temperature range (-40°C - +70°C) with good chemical and abrasive qualities. Boneham Nylon dowels work in vacuum environments and unlike traditional metal dowels, can easily be destroyed to prevent damage to the mould or workpiece.

ORDERING INSTRUCTIONS
When ordering identify the diameter and length required and choose the appropriate part number.

NOTES
/ Can be used with Boneham GS bushings or -BP mould bushings
/ Specials, including tighter tolerances Manufactured by BONEHAM.

DIAMETER TOLERANCES
2 – 5.5mm +/- 0.01
6 – 10mm 0.00 - + 0.02

METRIC

Part Code	D	L (0.00 - + 0.1)
N6DP0NU2C	3	20
N6DP0PU24B	2.4	30
N6DP0PU25B	2.5	30
N6DP0PU2C	3	30
N6DP0PW2C	3	35
N6DP0QU2C	3	40
N6DP0QW2C	3	45
N6DP0RU2C	3	50
N6DP0RW2C	3	55
N6DP0SU2C	3	60
N6DP0PU22C	3.2	30
N6DP0PU23C	3.3	30
N6DP0PU26C	3.6	30
N6DP0PU27C	3.7	30
N6DP0PU2D	4	30
N6DP5QU2D	4	35
N6DP0QU2D	4	40
N6DP5RU2D	4	45
N6DP0RU2D	4	50
N6DP5SU2D	4	55
N6DP0SU2D	4	60
N6DP0PU22D	4.2	30
N6DP0PU25D	4.5	30

Part Code	D	L (0.00 - + 0.1)
N6DP0PU2E	5	30
N6DP5QU2E	5	35
N6DP0QU2E	5	40
N6DP0RU2E	5	50
N6DP0PU25E	5.5	30
N6DP0QE2E	5.5	40
N6DP0PU2F	6	30
N6DP5QU2F	6	35
N6DP0QU2F	6	40
N6DP5RU2F	6	45
N6DP0RU2F	6	50
N6DP5SU2F	6	55
N6DP0SU2F	6	60
N6DP0QA2F	6.1	40
N6DP0PU28F	6.8	30
N6DP5QU28F	6.8	35
N6DP0QU28F	6.8	40
N6DP0PU2G	7	30
N6DP0QU2G	7	40
N6DP0PU2H	8	30
N6DP5QU2H	8	35
N6DP0QU2H	8	40
N6DP5RU2H	8	45

Part Code	D	L (0.00 - + 0.1)
N6DP0RU2H	8	50
N6DP5SU2H	8	55
N6DP0SU2H	8	60
N6DP0QU25H	8.5	40
N6DP0PU2I	9	30
N6DPB0NU2J	10	20
N6DP0PU2J	10	30
N6DP0QU2J	10	40
N6DP0RU2J	10	50
N6DP0SU2J	10	60
N6DP0PU2L	12	30
N6DP0QU2L	12	40

IMPERIAL

Part Code	D	L
N6DP0PU235F	1/4"	30
N6DP5QU235F	1/4"	35
N6DP0QU235F	1/4"	40
N6DP1CG5B	1/2"	30
N6DP1GG5B	1/2"	40
N6DP1CH5A	1/8"	30

Accurate Mould Alignment and Clamping Solutions from BONEHAM®

The Boneham Mould Clamping and Alignment solution combines components to produce a system that can be installed along a split mould, accommodating any pattern and spacing. With varying methods of either clamping or aligning the mould, these simple components are purpose designed to reduce scrapping of the pattern base, component or mould.

HUGE STOCKS

UK MANUFACTURING BONEHAM B&T PRECISION

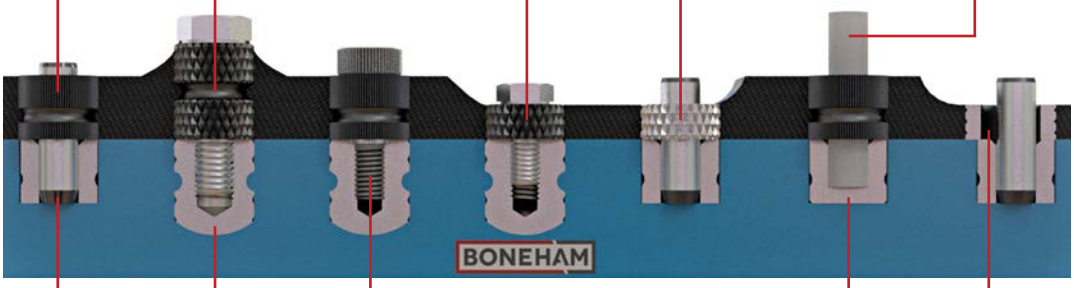
GS Serrated Bushes for pins
Page 38

Knurled Mould Bush for standard bolts
Page 65

Short Knurled Bush for standard bolts
Page 66

Short Knurled Bush to H7 for dowels
Page 66

Nylon 6 Dowel Pins
Page 63



Extractable dowel pins
Page 58-60

Knurled Mould Nut for bolts
Page 65

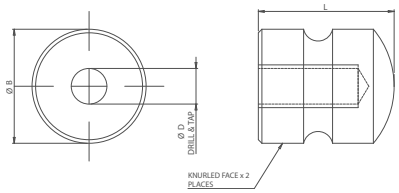
Ground Shoulder bolts
Page 334

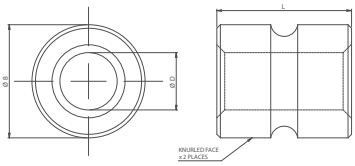
Blind GS Bushes for pins
Page 40

Slotted Mould Bushes for Pins
Page 67

Knurled Mould Clamps

A Boneham registered design for Split Moulds





VOLUME DISCOUNT

KEY FEATURES

/ Mild Steel
/ Chemically Blacked
/ Deep Knurl
/ Resin Recess
/ Compact Design

APPLICATION

Knurled Mould Clamps are designed by Boneham to be used in the composite mold process. The split composite mould process can require accurate alignment and good torque resistance. The GSCL mold clamp range is relatively compact and reduces mould scrappage whilst providing dedicated components which reduce subcontract and multicomponent requirements. The bushing and nut are purchased separately so a more precise bushing, such as a GS or PP type bushing can be used if required.

ORDERING INSTRUCTIONS

When ordering check the size of bolt and thread required and choose corresponding part number. Example:
/ M8 Bolt: Bushing: GSCL-8MM-B and Nut: GSCL-8MM-N

If a shoulder bolt is being used. Example:
/ 8MM Shoulder Bolt with 6mm thread: Bushing GS14-8.00MM and Nut: GSCL-6MM-N

Bushing Types
-B: Suitable for standard bolts

NOTES

/ Can be used as a nut and bushing assembly or with Boneham pins and drill bushes

Knurled Bushing – For use with standard bolt

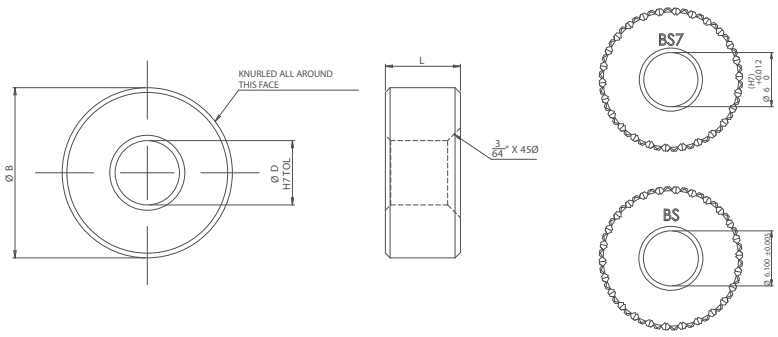
Part Code	Bore D	Outside Diameter B	Length L	Grooves
GSCL-6MM-B	6.1mm	5/8"	3/4"	1
GSCL-8MM-B	8.1mm	5/8"	3/4"	1
GSCL-10MM-B	10.1mm	5/8"	3/4"	1
GSCL-12MM-B	12.1mm	3/4"	3/4"	1

Knurled Nut – For use with standard bolt

Part Code	D	Outside Diameter B	Length L	Grooves
GSCL-6MM-N	M6	5/8"	3/4"	1
GSCL-8MM-N	M8	5/8"	3/4"	1
GSCL-10MM-N	M10	5/8"	3/4"	1
GSCL-12MM-N	M12	3/4"	3/4"	1

Short Knurled Mould Bush

A Boneham registered design for Split Moulds



VOLUME DISCOUNT

KEY FEATURES

/ Mild Steel
/ Chemically Blacked
/ Deep Knurl
/ Compact Design
/ 7mm Long

APPLICATION

The Short Knurled Mould Bush is a shortened version of the Knurled Mould Clamp Bush. The short version does not feature a resin groove, but allows for alignment when depth of locating material is at a minimum and a standard length bush is not suitable. The short mould clamp is available in two versions.
BS: Short version of -B for a fastening bolt
BS7: Machined for a locating dowel pin.

ORDERING INSTRUCTIONS

When ordering check the size of bolt and thread required and choose corresponding part number. Example:
/ M8 Bolt: Bush: GSCL-8MM-BS and Nut: GSCL-8MM-N
If a dowel pin is being used. Example:
/ DP35B 8MM Pin order: Bush GSCL-8MM-B7 and Nut: GSCL-6MM-N
Bush Types:
/ BS: Suitable for standard bolts
/ BS7: Suitable for Boneham Dowel Pins

NOTES

/ Can be used as a nut and bush assembly or with Boneham pins and drill bushes
/ Inch versions available

Knurled Bush – For use with standard bolt

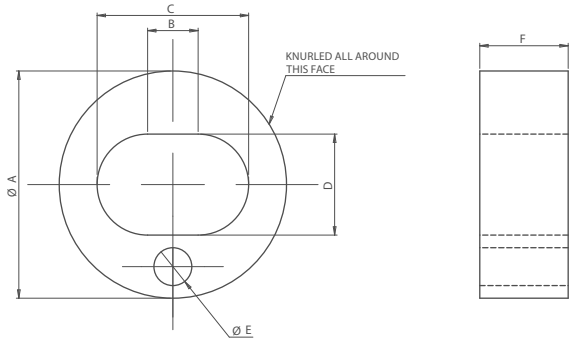
Part Code	Bore D	Outside Diameter B	Length L	Grooves
GSCL-6MM-BS	8.1mm	5/8"	7mm	0
GSCL-8MM-BS	6.1mm	5/8"	7mm	0

Knurled Bush – For use with standard Dowels

Part Code	Bore D H7	Outside Diameter B	Length L	Grooves
GSCL-6MM-BS7	6mm	5/8"	7mm	0
GSCL-8MM-BS7	8mm	5/8"	7mm	0

Knurled Slotted Mould Bush

For Composite Moulds



VOLUME DISCOUNT

KEY FEATURES
/ Mild Steel
/ Chemically Blacked
/ Deep Knurl
/ Compact Design
/ 7mm Long

APPLICATION
Knurled Slotted Mould Bushes are designed for the mould tool-up process. During a curing process thermal expansion may occur causing the movement of the mating bushes in the base mould. Boneham have designed the Slotted Mould Bush to allow for variable expansion by accepting natural longitudinal adjustment, preventing misalignment. They are designed to accept standard dowel pins. The elongated bushing features a drilled hole to assist in clocking up the bush during setting.

ORDERING INSTRUCTIONS
When ordering check the size of pin in use and choose corresponding part number. Example:
/ 8mm pin order: CLS8MM

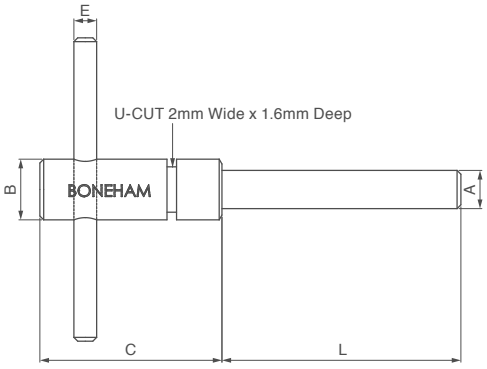
NOTES
/ Can be used with Boneham pins and drill bushes

Slotted Bushing – For use with Standard Dowels

Part Code	Slot W x L	Outside Diameter A	Length F	Clock Pin
CLS6MM	6mm x 10mm	18mm	7mm	3mm
CLS8MM	8mm x 12mm	18mm	7mm	3mm
CLS10MM	10mm x 14mm	24mm	10mm	3mm

Quick removing “T-Bar” Location Pins

Metric and Imperial



VOLUME DISCOUNT

APPLICATION
T-Bar Location Pins, or Jig Pins, are a removable precision ground location pin which is designed to accurately align holes in sectional jigs. The ground finish pin can be used in conjunction with Boneham’s standard liner bushes pressed into the jig. Quick removal is assisted thanks to the featured shoulder of the pin which allows a raised handle and a slide pin which can be tapped into an ‘L-shaped’ pin if necessary. In both metric and imperial and with various lengths, the T-Bar pins can be used in various applications of alignment and location.

MATERIAL
Body: Mild Steel
Pin: Case Hardened and Ground
Available in Stainless Steel

TIP
Use with BONEHAM bushes for accurate alignment in jigs.

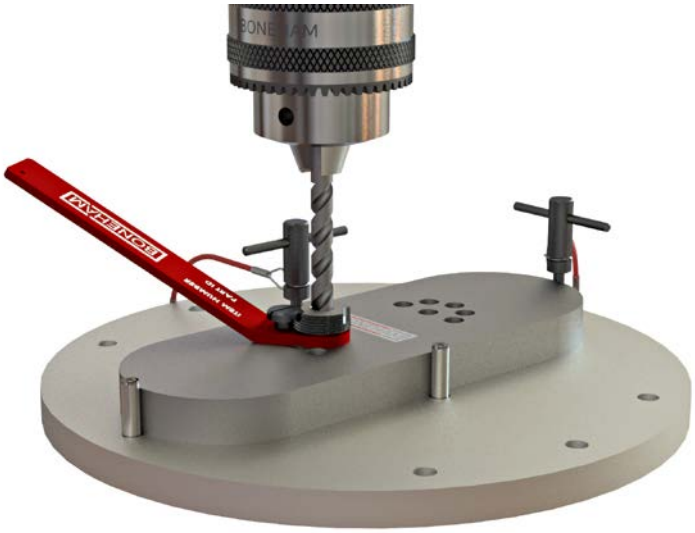
IMPERIAL SIZES

Part Reference	Pin Diameter A		Pin	Body		T-Bar	
	Nominal	Tolerance	Length	Diameter	Length	Length	Diameter
			L	B	C	D	E
RLP-1AS	3/16	-0.00015” -0.00045”	2"	3/8	1+1/4	1+3/4	3/16
RLP-2AS	1/4	-0.0002” -0.0006”	2”	1/2	1+1/2	2+1/2	3/16
RLP-2BS	5/16	-0.0002” -0.0006”	2"	1/2	1+1/2	2+1/2	3/16
RLP-3AS RLP-3AM	3/8	-0.0002" -0.0006"	2" 3"	5/8	1+1/2	2+3/4	1/4
RLP-4AS RLP-4AL	1/2	-0.0002" -0.0006"	2" 4"	3/4	1+3/4	2+3/4	1/4

Continued on next page

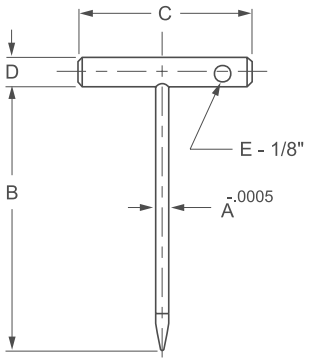
METRIC SIZES

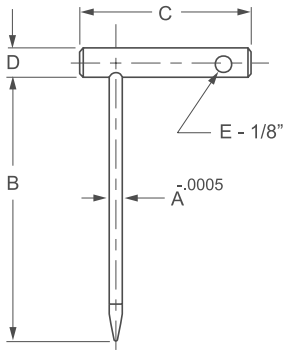
Part Reference	Pin Diameter A		Pin	Body		T-Bar	
	Nominal	Tolerance	Length	Diameter	Length	Length	Diameter
			L	B	C	D	E
MRLP-1AS MRLP-1AM	5	-0.004mm -0.012mm	25 50	3/8	1+1/4	1+3/4	3/16
MRLP-2AS MRLP-2AM	6	-0.004mm -0.012mm	25 50	1/2	1+1/2	2+1/2	3/16
MRLP-2BS MRLP-2BM	7	-0.005mm -0.014mm	25 50	1/2	1+1/2	2+1/2	3/16
MRLP-2CS MRLP-2CM	8	-0.005mm -0.014mm	25 50	1/2	1+1/2	2+1/2	3/16
MRLP-3AM MRLP-3AL	9	-0.005mm -0.014mm	50 75	5/8	1+1/2	2+3/4	1/4
MRLP-3BM MRLP-3BL	10	-0.005mm -0.014mm	50 75	5/8	1+1/2	2+3/4	1/4
MRLP-4AM MRLP-4AL	12	-0.005mm -0.014mm	50 75	3/4	1+3/4	2+3/4	1/4



L-Pins and T-Pins

Case Hardened Steel – Black Oxide Finish





VOLUME DISCOUNT

KEY FEATURES
- Precision ground pin
- Case hardened steel
- Black oxide finish
- Drilled handle for cable assembly

APPLICATION
L Shaped Alignment Pins LP:
L-Pins are used to align location devices in Jig and Fixtures. They are precise and quick to remove. The 'L' shape is ideal when working space is restrictive. A cross drilled 1/8 hole is supplied in the handle to connect the pin to the fixture using an optional cable of lanyard.

T Shaped Alignment Pins TP:
T-Pins are used to align location devices in Jig and Fixtures. They are precise and quick to remove. The T shaped pins allow for greater grip control and easy removal. A cross drilled 1/8 hole is supplied in the handle to connect the pin to the fixture using an optional cable of lanyard."

ORDERING INSTRUCTIONS
When ordering identify the nominal diameter required and then choose the length from the chart below. Example: 0.1910 x 6

NOTES
If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification.

INCH Alignment Pins

T-PIN Part No.	L-PIN Part No.	Dimensions A (+.0000 -.0005)	B (+-.06)	C	D	E (+-.06)
TP125025	LP125025	0.1250	2-1/2	1-1/2	1/4	1/4
TP156235	LP156235	0.1562	3-1/2	2-1/2	5/16	1/4
TP18753	LP18753	0.1875	3	2-1/2	5/16	1/4
TP18754	LP18754	0.1875	4	2-1/2	5/16	1/4
TP18756	LP18756	0.1875	6	2-1/2	5/16	1/4
TP19103	LP19103	0.1910	3	2-1/2	5/16	1/4
TP19104	LP19104	0.1910	4	2-1/2	5/16	1/4
TP19106	LP19106	0.1910	6	2-1/2	5/16	1/4
TP19603	LP19603	0.1960	3	2-1/2	5/16	1/4
TP25002	LP25002	0.2500	2	2-1/2	3/8	3/8
TP25003	LP25003	0.2500	3	2-1/2	3/8	3/8
TP25004	LP25004	0.2500	4	2-1/2	3/8	3/8

ALL DIMENSIONS IN INCHES

Continued on next page

INCH Alignment Pins

T-PIN Part No.	L-PIN Part No.	Dimensions				
		A (+.0000 -.0005)	B (+-.06)	C	D	E (+-.06)
TP25006	LP25006	0.2500	6	2-1/2	3/8	3/8
TP25703	LP25703	0.2570	3	2-1/2	3/8	3/8
TP25704	LP25704	0.2570	4	2-1/2	3/8	3/8
TP31252	LP31252	0.3125	2	2-1/2	7/16	1/2
TP312535	LP312535	0.3125	3-1/2	3	7/16	1/2
TP31254	LP31254	0.3125	4	3	7/16	1/2
TP31256	LP31256	0.3125	6	3	7/16	1/2
TP37503	LP37503	0.3750	3	2-1/2	1/2	1/2
TP37504	LP37504	0.3750	4	3-1/2	1/2	1/2
TP37505	LP37505	0.3750	5	3-1/2	1/2	1/2
TP37506	LP37506	0.3750	6	3-1/2	1/2	1/2
TP37507	LP37507	0.3750	7	3-1/2	1/2	1/2
TP43754	LP43754	0.4375	4	3-1/2	9/16	5/8
TP43755	LP43755	0.4375	5	3-1/2	9/16	5/8
TP43756	LP43756	0.4375	6	3-1/2	9/16	5/8
TP50004	LP50004	0.5000	4	3-1/2	9/16	5/8
TP50005	LP50005	0.5000	5	3-1/2	9/16	5/8
TP50006	LP50006	0.5000	6	3-1/2	9/16	5/8
TP50007	LP50007	0.5000	7	3-1/2	5/8	5/8
TP50009	LP50009	0.5000	9	3-1/2	5/8	5/8
TP56254	LP56254	0.5625	4	3-1/2	5/8	5/8
TP56256	LP56256	0.5625	6	3-1/2	5/8	5/8
TP62506	LP62506	0.6250	6	3-1/2	7/8	3/4
TP62508	LP62508	0.6250	8	3-1/2	7/8	3/4
TP75006	LP75006	0.7500	6	3-1/2	7/8	3/4

ALL DIMENSIONS IN INCHES

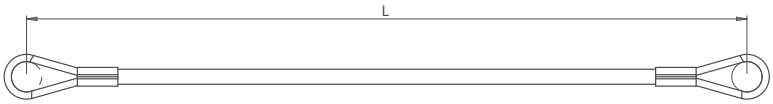
METRIC Alignment Pins

T-PIN Part No.	L-PIN Part No.	Dimensions				
		A (+.0000 -.0005)	B (+-.06)	C	D	E (+-.06)
TP488	LP488	4	88	64	8	8
TP576	LP576	5	76	64	8	8
TP5152	LP5152	5	152	64	8	8
TP676	LP676	6	76	64	10	10
TP6152	LP6152	6	152	64	10	10
TP888	LP888	8	88	76	11	11
TP8152	LP8152	8	152	76	11	11
TP1076	LP1076	10	76	64	13	13
TP10152	LP10152	10	152	88	13	13
TP12102	LP12102	12	102	88	16	16
TP12152	LP12152	12	152	88	16	16
TP16152	LP16152	16	152	88	22	22
TP16204	LP16204	16	204	88	22	22
TP20152	LP20152	20	152	88	22	22
TP20204	LP20204	20	204	88	22	22

ALL DIMENSIONS IN MILLIMETERS

Cable

Cables for Fixtures



HUGE STOCKS

STAINLESS STEEL

KEY FEATURES
/ Red nylon jacket
/ 4" to 24" long
/ Loop to loop configuration
/ 304 stainless steel cable
/ Aluminium crimps

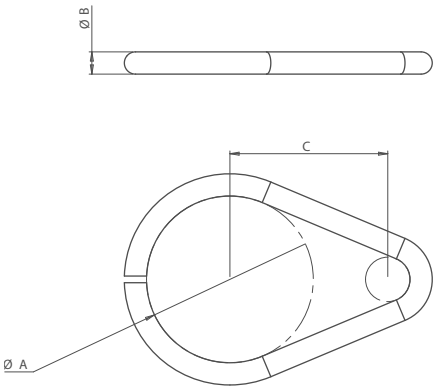
APPLICATION
Boneham cables are ideal for linking removable location or alignment components to a fixture. Cables prevent damage or loss of the component by fixing one end of the cable to the fixture and the other to the component.

ORDERING INSTRUCTIONS
When ordering: Choose length of wire required and order corresponding part number. Clips are ordered separately.

Part No.	L	Loop Fixing Size
LC4R	4"	1/4"
LC6R	6"	1/4"
LC8R	8"	1/4"
LC10R	10"	1/4"
LC12R	12"	1/4"
LC16R	16"	1/4"
LC20R	20"	1/4"
LC24R	24"	1/4"

Cable Clips

Clips for Cables



VOLUME DISCOUNT

KEY FEATURES
- Use with Boneham Cables
- To suit T-Bar and Alignment Pins
- 304 Stainless Steel
- Simple economic cable solution

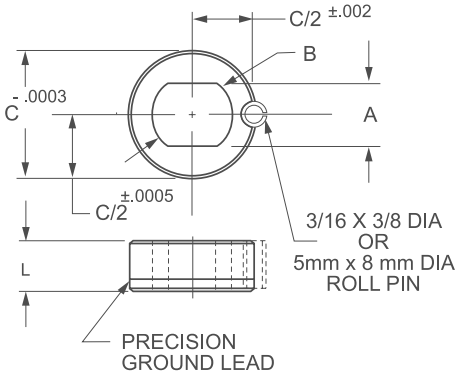
APPLICATION
Retaining Clips for Boneham cables are a simple and economic method of securing components to cables (lanyards) which then prevent loss or damage to important location and alignment pins on fixtures.

ORDERING INSTRUCTIONS
When ordering: Identify the clip size required and choose corresponding part number. Lanyards ordered seperately.

Part No.	A (ID)	B	C
LCC8.5SS	0.335	0.039	0.279
LCC11.5SS	0.453	0.047	0.343
LCC14.5SS	0.571	0.063	0.405
LCC17.5SS	0.689	0.063	0.468
LCC20.5SS	0.807	0.078	0.532

Slotted Locator Bushes

SL Type Press-Fit Locator Bush



VOLUME DISCOUNT

KEY FEATURES
- / INCH (SL) and Metric (SLM)
- / Heat treated to HRC 58-62
- / Precision ground
- / Black oxide finish

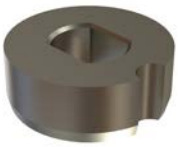
APPLICATION
Boneham's 'SL Type' Slotted Locator Bushes are designed for use with 'L' or 'T' Pins. Using a configuration with a high tolerance bush, Slotted Location Bushes allow for relief in one direction during alignment, whilst maintaining tight tolerances in the other direction.

ORDERING INSTRUCTIONS
When ordering identify the slot width required and select the appropriate part number. Example: SL-488-A

NOTES
To Install:
- / Drill and ream a 3/16 for the Inch roll pin or 5mm for the metric assembly
- / Then bore a press fit hole with an interference fit of 0.0003 to 0.0005
- / Press the roll pin and locator bush in together until flush. The relationship between the roll pin and bush provides accurate orientation.

Roll Pin Included:
Inch: 3/16 x 3/8
Metric: 5mm x 8mm

- / Stainless can be manufactured upon request. Please talk to the technical sales team.

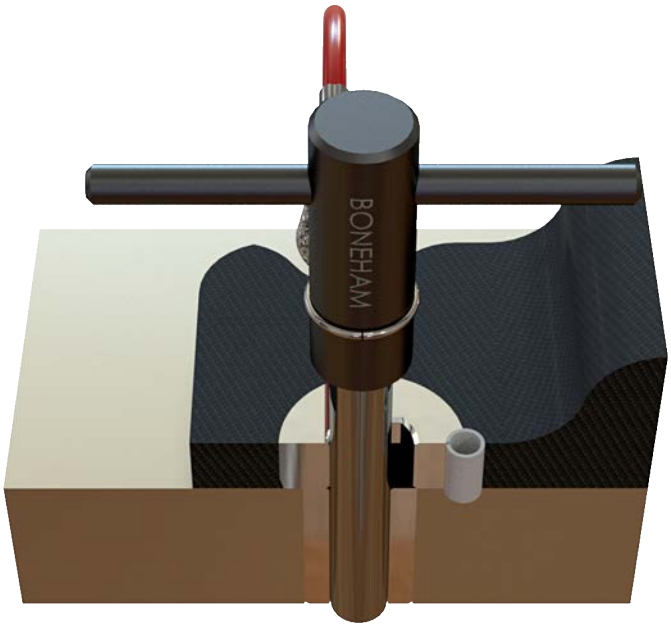


INCH

Part No.	A	B	C	L	Pin Dia.
SL-488-A	.1876 / .1882	0.312	0.7504	0.40	3/16
SL-488-B	.2501 / .2507	0.375	0.7504	0.40	1/4
SL-648-A	.2501 / .2507	0.375	1.0004	0.40	1/4
SL-648-B	.3126 / .3132	0.437	1.0004	0.40	5/16
SL-648-C	.3751 / .3757	0.500	1.0004	0.40	3/8
SL-648-D	.5001 / .5007	0.625	1.0004	0.40	1/2
SL-6416	.5001 / .5007	0.625	1.0004	0.90	1/2
SL-8016	.6251 / .6257	0.750	1.2504	0.90	5/8
SL-9616-A	.7501 / .7510	0.812	1.5004	1.00	3/4
SL-9616-B	.8751 / .8760	1.000	1.5004	1.00	7/8
SL-9616-C	1.0001 / 10010	1.062	1.5004	1.00	1

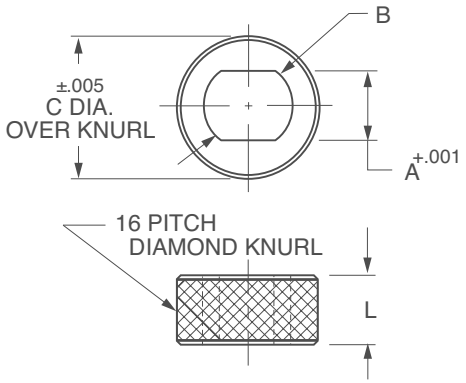
METRIC

Part No.	A	B	C	L	Pin Dia.
SLM6	6.00 / 6.03mm .2363 / .2373	9mm 0.354	20mm 0.787	9mm 0.354	6mm
SLM8	8.00 / 8.03mm .3151 / .3161	11mm 0.423	24mm 0.945	9mm 0.354	8mm
SLM10	10.00 / 10.30mm .3938 / .3948	13mm 0.512	24mm 0.945	9mm 0.354	10mm
SLM12	12.00 / 12.03mm .4725 / .4735	15mm 0.591	24mm 0.945	14mm 0.551	12mm
SLM16	16.00 / 16.03mm .6300 / .6310	18mm 0.709	30mm 1.181	12mm 0.472	16mm
SLM20	20.00 / 20.03mm .7875 / .7885	22mm 0.866	36mm 1.417	19mm 0.748	20mm
SLM25	25.00 / 25.03mm .9844 / .9854	27mm 1.063	40mm 1.575	19mm 0.748	25mm



Slotted Locator Bushes

KSL Type Knurled Locator Bushes



VOLUME DISCOUNT

KEY FEATURES
- Inch sizes
- Heat treated to HRC 58-62
- Knurled OD
- Ground

APPLICATION
Boneham Metal Products KSL type bushes are designed with a knurled OD for setting or casting into composites or soft materials. Like the 'SL type' these locator bushes are used with locator pins such as the 'L' or 'T' pins. The slotted bush allows for relief in one direction during alignment, whilst maintaining tight tolerances in the other direction.

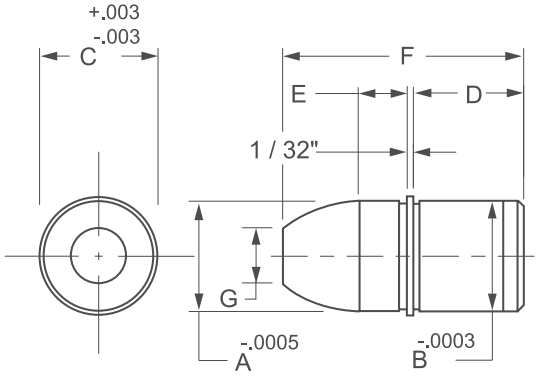
ORDERING INSTRUCTIONS
When ordering identify the slot width required and select corresponding part number. Example: KSL-408

NOTES
The KSL bushes OD diamond knurl allows for the locator bush to be embedded into materials such as composites.

Part No.	A	B	C	L	PIN DIA
KSL-368	0.1876	0.312	0.565	0.500	3/16
KSL-408	0.2501	0.375	0.640	0.500	1/4
KSL-488	0.3126	0.437	0.765	0.500	5/16
KSL-568	0.3751	0.500	0.890	0.500	3/8
KSL-648	0.5001	0.625	1.015	0.500	1/2
KSL-9616	0.5001	0.625	1.015	1.000	1/2

Location Pins

Bullet Nose Dowels



VOLUME DISCOUNT

KEY FEATURES
/ Precision ground location system
/ Case hardened
/ Black oxide finish
/ Concentric to 0.0005" TIR
/ INCH and Metric sizes

APPLICATION
Bullet Nose Dowels BND are used in conjunction with a Bullet Nose Liner BNL to create a precision location system, aligning two work pieces with complete accuracy. The pins head and body diameters are concentric to within .0005" TIR.

ORDERING INSTRUCTIONS
When ordering identify the diameter required and identify the part number from the chart below. Example: BND2499

NOTES
If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification.

INCH

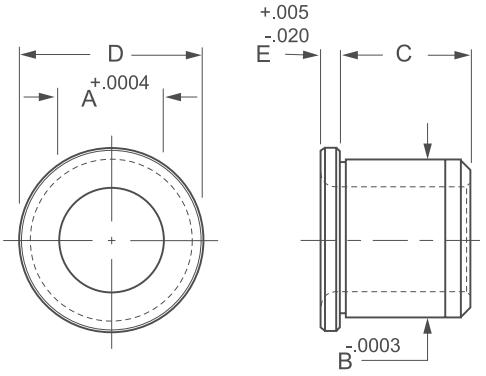
Part No.	Dimensions								Mating Liner Part No.
	A +.0000 -.0005		B +.0000 -.0003	C +/- .003	D	E	F	G	
	NOMINAL	ACTUAL							
BND2499	1/4	.2499	.2516	.280	.500	.125	.907	1/8	BNL2501
BND3124	5/16	.3124	.3141	.344	.500	.157	.939	5/32	BNL3126
BND3749	3/8	.3749	.3766	.407	.500	.187	1.032	3/16	BNL3751
BND4999	1/2	.4999	.5017	.532	.500	.187	1.094	1/4	BNL5001

METRIC

Part No.	Dimensions							Mating Liner Part No.
	A +.0000 -.0005	B +.0000 -.0003	C +/- .003	D	E	F	G	
BNDM600	6mm	6mm	7mm	12mm	3mm	22mm	1/8	BNLM600
BNDM800	8mm	8mm	9mm	12mm	4mm	23mm	5/32	BNLM800
BNDM1000	10mm	10mm	11mm	12mm	5mm	25mm	3/16	BNLM1000
BNDM1200	12mm	12mm	15mm	12mm	5mm	27mm	1/4	BNLM1200

Location Pins

Liner for Bullet Nose Dowels



VOLUME DISCOUNT

KEY FEATURES
- Precision ground location system
- Case hardened
- Black oxide finish
- ID / OD Concentric to 0.0003" TIR
- INCH and Metric sizes

APPLICATION
Liners for Bullet Nose Dowels are the receiving bush element of the location system. The bushes ID and OD are concentric to within .0003 TIR.

ORDERING INSTRUCTIONS
When ordering identify the ID required and identify the part number from the chart below. Example: BNL3751

NOTES
If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification.

INCH

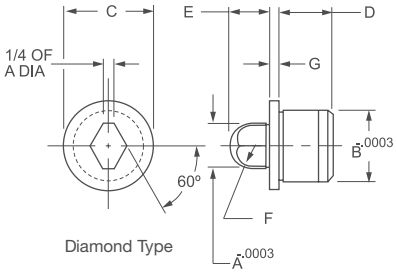
Part No.	Dimensions					
	A .0000 / +.0004		B +.0000 -.0003	C +/- .003	D	E
	NOMINAL	ACTUAL				
BNL2501	1/4	0.2501	0.5017	3/8	0.625	.100
BNL3126	5/16	0.3126	0.5017	3/8	0.625	.100
BNL3751	3/8	0.3751	0.6267	1/2	0.750	.100
BNL5001	1/2	0.5001	0.7518	5/8	0.875	.100

METRIC

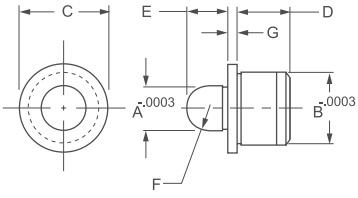
Part No.	Dimensions				
	A .0000 / +.0004	B - .0003	C	D	E +.005 / -.020
BNLM600	6mm	10mm	7mm	13mm	3mm
BNLM800	8mm	12mm	7mm	15mm	3mm
BNLM1000	10mm	15mm	9mm	18mm	3mm
BNLM1200	12mm	18mm	12mm	22mm	3mm

Location Pins

Bullet Nose Pins



Diamond Type



Round Type

VOLUME DISCOUNT

KEY FEATURES
- Precision ground location system
- Case hardened
- Black oxide finish
- Concentric to .0005" TIR
- INCH and Metric sizes

APPLICATION
Bullet Nose Pins come in two different forms, round BNR or diamond (relieved) BNP. Bullet Nose Pins are used with a mating bush BNPL to create an accurate alignment and locating system. Using a relieved diamond pin maintains accuracy in alignment but prevents binding of the work pieces. For simple installation the OD of the pin and the bush are exactly the same to allow for one pass boring of the holes in both plates. The pins head and body are concentric to .0005 TIR.

ORDERING INSTRUCTIONS
When ordering identify the diameter of the pin required and select the part number from the chart below.
Example: BNR4998

NOTES
If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification.

INCH

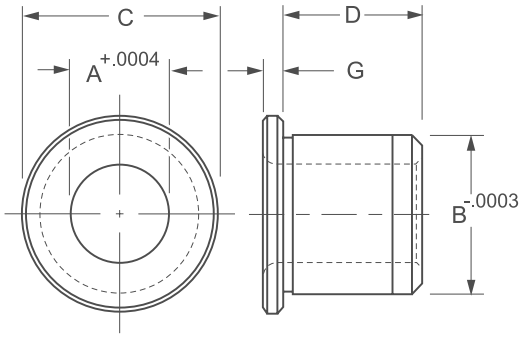
Part No.		Dimensions									
Round Pin	Diamond Pin	A -.0003		B -.0003		C	D	E	F	G	Mating Liner Part No.
		NOMINAL	ACTUAL	NOMINAL	ACTUAL						
BNR2499	BNP2499	1/4	0.2499	13/32	0.4078	9/16	3/8	7/32	1/8	1/16	BNPL2501
BNR3124	BNP3124	5/16	0.3124	1/2	0.5017	5/8	3/8	9/32	5/32	1/16	BNPL3126
BNR3748	BNP3748	3/8	0.3748	5/8	0.6267	3/4	1/2	11/32	3/16	1/16	BNPL3751
BNR4998	BNP4998	1/2	0.4998	3/4	0.7518	7/8	1/2	13/32	1/4	1/16	BNPL5001
BNR7498	BNP7498	3/4	0.7498	1	1.0018	1+1/8	3/4	9/16	3/8	1/8	BNPL7502
BNR9998	BNP9998	1	0.9998	1+3/8	1.3771	1+1/2	3/4	3/4	1/2	1/8	BNPL1000

METRIC

Part No.		Dimensions							Mating Liner Part No.
Round Pin	Diamond Pin	A -0.0003	B -0.0003	C	D	E	F	G	
BNRM600	BNDPM600	6mm	10mm	13mm	9mm	6mm	3mm	2mm	BNPLM600
BNRM800	BNDPM800	8mm	12mm	15mm	9mm	7mm	4mm	2mm	BNPLM800
BNRM1000	BNDPM1000	10mm	15mm	18mm	11mm	9mm	5mm	2mm	BNPLM1000
BNRM1200	BNDPM1200	12mm	18mm	22mm	11mm	10mm	6mm	2mm	BNPLM1200

Location Pins

Liner for Bullet Nose Pins



VOLUME DISCOUNT

KEY FEATURES
- / Precision ground location system
- / Case hardened
- / Black oxide finish
- / ID / OD Concentric to .0003" TIR
- / INCH and Metric sizes

APPLICATION
Liners for bullet nose pins are the receiving bush element of the location system. The bush OD is the same size as the pins diameter and is concentric to the ID within .0003 TIR.

ORDERING INSTRUCTIONS
When ordering identify the ID required and identify the part number from the chart below.
Example: BNPL5001

NOTES
If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification.

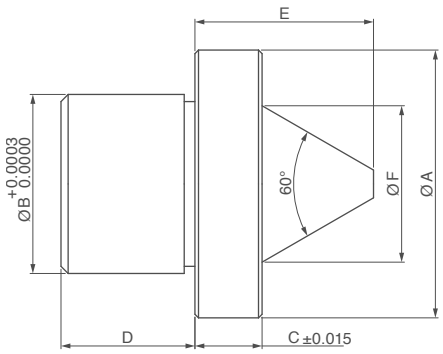
INCH

Part No.	Dimensions					
	A +.0004		B -.0003	C	D	G
	NOMINAL	ACTUAL				
BNPL2501	1/4	0.2501	0.4078	9/16	7/16	1/16
BNPL3126	5/16	0.3126	0.5017	5/8	7/16	1/16
BNPL3751	3/8	0.3751	0.6267	3/4	7/16	1/16
BNPL5001	1/2	0.5001	0.7518	7/8	1/2	1/16
BNPL7502	3/4	0.7502	1.0018	1-1/8	1/2	1/8
BNPL10000	1	1.0002	1.3771	1-1/2	11/16	1/8

METRIC

Part No.	Dimensions				
	A +.0004	B - .0003	C	D	G
BNPLM600	6mm	10mm	13mm	8mm	2mm
BNPLM800	8mm	12mm	15mm	8mm	2mm
BNPLM1000	10mm	15mm	18mm	10mm	2mm
BNPLM1200	12mm	18mm	22mm	10mm	2mm

Easy-Cone Locator Pin



VOLUME DISCOUNT

KEY FEATURES
- Rapid location
- Hardened and Blacked
- 60° Conical Profile
- Ground body for accurate setting
- Metric and Inch

APPLICATION
Easy Cone Locators are a reduced precision location device. Accuracy is +/- 0.0003" on the OD of the bush and pin. But unlike other precision locators supplied by Boneham, they are not tied down on the conical location point. The 60° conical locating point provides rapid alignment properties. Misalignment is compensated for by the distance from the peak of the cone to edge of the entry point of the bush. This is the right solution for quick alignment of two workpieces in a repetitive production environment. A one operation preparation process can be used, boring both plates at the same time, with both OD's of the pin and bush being the same.

ORDERING INSTRUCTIONS
When ordering identify the diameter required and find the part number in the below table. Mating bushes are referenced in the table.

NOTES
Can't find what you are looking for? Boneham can manufacture special sizes and materials to specification.

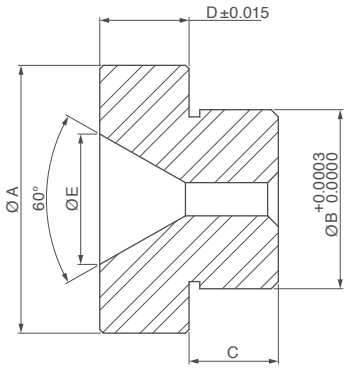
INCH

Part No.	A Dia	B Dia		C	D	E	F Dia	Clearance Between Bushing and Pin Assembly (Inch)
		NOM (Inch)	ACTUAL (Inch)					
CLP5014	3/4"	1/2"	0.5014	3/16"	3/8"	5/16"	0.438	.050-.068
CLP7515	1	3/4"	0.7515	3/16"	9/16"	1/2"	0.676	.043-.061

METRIC

Part No.	A Dia	B Dia		C	D	E	F Dia	Clearance Between Bushing and Pin Assembly (mm)
		NOM (mm)	ACTUAL (mm)					
CLPM1200	19	12	12.034	4.76	9.5	7.9	11.1	1.27-1.73
CLPM2000	25.5	20	20.038	4.76	14.5	12.7	17.2	1.09-1.55

Easy-Cone Locator Bush



VOLUME DISCOUNT

KEY FEATURES
/ Rapid location
/ Hardened and Blacked
/ 60° Conical Profile
/ Ground body for accurate setting
/ Metric and Inch

APPLICATION
Easy Cone Locators are a reduced precision location device. Accuracy is +/- 0.0003" on the OD of the bush and pin. But unlike other precision locators supplied by Boneham, they are not tied down on the conical location point. The 60° conical locating point provides rapid alignment properties. Misalignment is compensated for by the distance from the peak of the cone to edge of the entry point of the bush. This is the right solution for quick alignment of two workpieces in a repetitive production environment. A one operation preparation process can be used, boring both plates at the same time, with both OD's of the pin and bush being the same.

ORDERING INSTRUCTIONS
When ordering identify the diameter required and find the part number in the below table. Mating bushes are referenced in the table.

NOTES
Can't find what you are looking for? Boneham can manufacture special sizes and materials to specification.

IMPERIAL

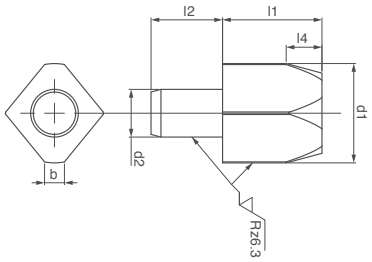
Part No.	A Dia	B Dia		C	D	E Dia	Clearance Between Bush and Pin Assembly (Inch)
		NOM (Inch)	ACTUAL (Inch)				
CLB5014	3/4	1/2	0.5014	1/4	1/4	0.37	.050-.068
CLB7515	1	3/4	0.7515	3/8	3/8	0.616	.043-.061

METRIC

Part No.	A Dia	B Dia		C	D	E Dia	Clearance Between Bush and Pin Assembly (mm)
		NOM (mm)	ACTUAL (mm)				
CLBM1200	19	12	12.034	6.4	6.35	9.4	1.27-1.73
CLBM2000	25.5	20	20.038	9.5	9.52	15.65	1.09-1.55

Location and Seating Pins

Diamond Type Form C / Flattened Locating Pin / DIN 6321

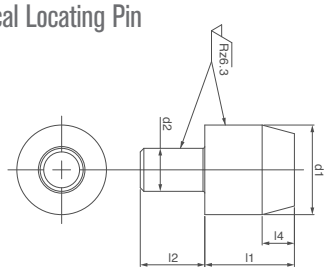


VOLUME DISCOUNT

MATERIAL
/ Tool steel hardened and ground

REF	d1	l1		b	d2	l2	l4
	g6	short	long		n6		
LPF1-3622	6	7	12	1-0	4	6	4
LPF2-3622	8	10	16	1-6	6	9	6
LPF3-3622	10	10	18	2-5	6	9	6
LPF4-3622	12	10	18	2-5	6	9	6
LPF5-3622	16	13	22	3-5	8	12	8
LPF6-3622	20	15	25	5-0	12	18	9
LPF7-3622	25	15	25	5-0	12	18	9

Round Type Form B / Cylindrical Locating Pin



VOLUME DISCOUNT

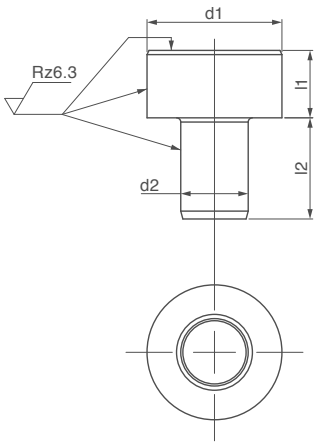
MATERIAL
/ Tool steel hardened and ground

ORDERING INSTRUCTIONS
Advise ref and l1 size short or long.
Note: add suffix S or L to reference. (eg. LPF1-3622 s)

REF	d1	l1		d2	l2	l4
	g6	short	long	n6		
LPR1-3622	6	7	12	4	6	4
LPR2-3622	8	10	16	6	9	6
LPR3-3622	10	10	18	6	9	6
LPR4-3622	12	10	18	6	9	6
LPR5-3622	16	13	22	8	12	8
LPR6-3622	20	15	25	12	18	9
LPR7-3622	25	15	25	12	18	9

Location and Seating Pins

Flat Type Form A / Seating Pin / DIN 6321



VOLUME DISCOUNT

MATERIAL
/ Tool steel hardened and ground

ORDERING INSTRUCTIONS
Advise ref and l1 size short or long.
Note: add suffix S or L to reference. (eg. LPR1-3622 s)

/ l_1 = h9 and can be used at a bearing surface in jigs.

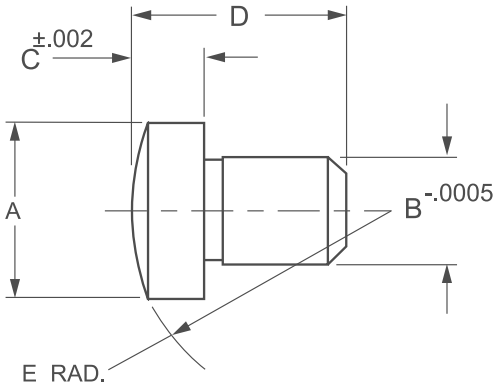
/ Location pins are used to locate work pieces and fixtures or as stops.

DIN 6321

REF	d1 g6	l1	l2	d2 n6
SP1-3622	6	5	6	4
SP2-3622	10	6	9	6
SP3-3622	16	8	12	8
SP4-3622	25	10	18	12

Location Pins

SLB Type Spherical Locator



VOLUME DISCOUNT

KEY FEATURES
/ Case hardened
/ Black oxide finish
/ Pin tolerance -.0005
/ Head thickness +/- .002

APPLICATION
Boneham's Spherical Locator Buttons are designed for irregular work surface applications, the spherical radius creates a single point of contact on contoured workpieces. The features of the SLB allow for other uses such as jig feet and rest pads. The pin element of the button is ground to allow for press fit.

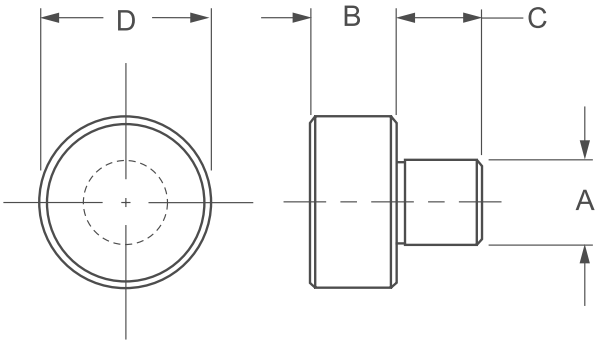
ORDERING INSTRUCTIONS
When ordering identify the pin diameter and head depth required and select the appropriate part number. Example: SLB5000

NOTES
/ Stainless and specials can be manufactured upon request. Please talk to the technical sales team.
/ Metric sizes upon request.

Part No.	Dimensions				
	A	B + .0000 -.0005	C + / - .002	D	E
SLB3750	5/16	0.1890	1/8	3/8	1/2
SLB5000	3/8	0.2515	3/16	1/2	5/8
SLB5625	1/2	0.3765	3/16	9/16	3/4
SLB6250	1/2	0.3765	1/4	5/8	3/4
SLB7500	1/2	0.3765	3/8	3/4	3/4
SLB8750	1/2	0.3765	1/2	7/8	3/4

Rest Buttons

Round Rest Buttons



VOLUME DISCOUNT

KEY FEATURES
/ Pin diameters from 0.1885 to 0.7515
/ Finish ground head thickness +/ -0.001
/ Pin tolerance -.0005
/ Case hardened
/ Black oxide finish

APPLICATION
Round Rest Buttons RB are a precise and accurate method of supporting, height setting or resting a work piece in a fixture. They are designed to press fit, with the head thickness also precision ground.

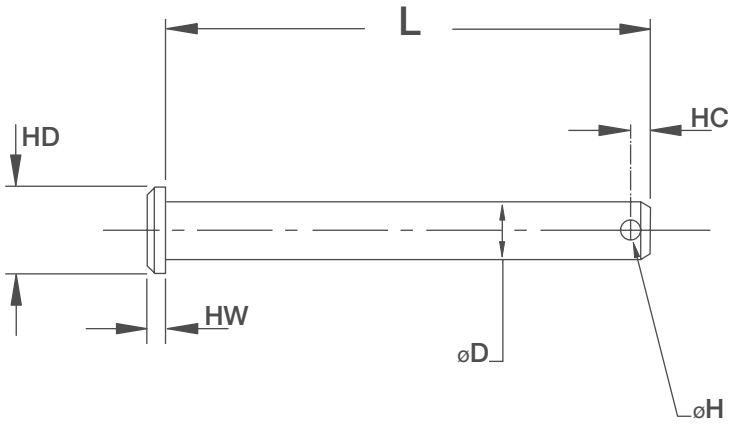
ORDERING INSTRUCTIONS
When ordering identify the pin diameter and head depth required and select the appropriate part number. Example: RB28

NOTES
/ Stainless and specials can be manufactured upon request. Please talk to the technical sales team.
/ Metric sizes upon request.

Part No.	Dimensions				
	A +.0000 / -.0005		B -.000 / +.001	C	D
	NOMINAL	ACTUAL			
RB02	3/16	0.1885	0.250	3/8	3/8
RB04	3/16	0.1885	0.375	3/8	3/8
RB06	3/16	0.1885	0.500	3/8	3/8
RB08	1/4	0.2510	0.250	1/2	1/2
RB10	1/4	0.2510	0.375	1/2	1/2
RB12	1/4	0.2510	0.500	1/2	1/2
RB14	5/16	0.3135	0.250	1/2	9/16
RB16	5/16	0.3135	0.375	1/2	9/16
RB18	5/16	0.3135	0.500	1/2	9/16
RB20	3/8	0.3760	0.250	5/8	5/8
RB22	3/8	0.3760	0.375	5/8	5/8
RB24	3/8	0.3760	0.500	5/8	5/8
RB26	3/8	0.3760	0.625	5/8	5/8
RB28	3/8	0.3760	0.750	5/8	5/8
RB30	1/2	0.5010	0.375	5/8	7/8
RB32	1/2	0.5010	0.500	5/8	7/8
RB34	1/2	0.5010	0.625	5/8	7/8
RB36	1/2	0.5010	0.750	5/8	7/8
RB38	5/8	0.6260	0.375	3/4	1
RB40	5/8	0.6260	0.500	3/4	1
RB42	5/8	0.6260	0.625	3/4	1
RB44	5/8	0.6260	0.750	3/4	1
RB46	3/4	0.7515	0.500	7/8	1-1/4
RB48	3/4	0.7515	0.625	7/8	1-1/4

Clevis Pins – Metric

ISO 2341 B DIN 1444 B



HUGE STOCKS

VOLUME DISCOUNT

STAINLESS STEEL

MATERIAL

/ Steel Bright Zinc Plated (CPZP) – Stainless Steel Type A2 (CPSS)

ORDERING INSTRUCTIONS

/ State CPSS for stainless steel or CPZP for Zinc Plated. When ordering give D x L

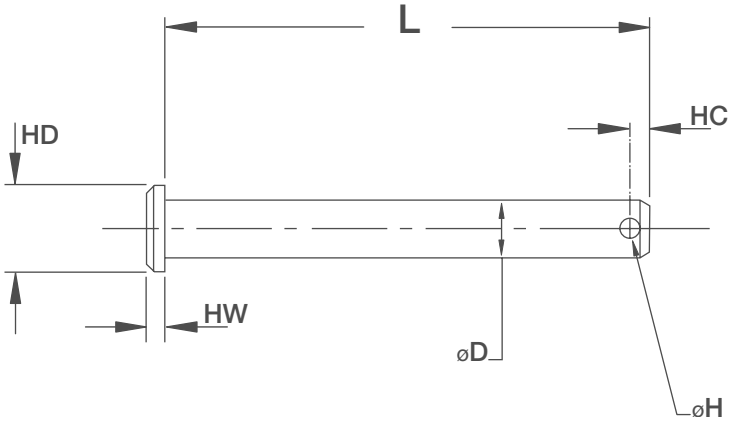
NOTES

Some feature sizes on our clevis pins have been altered from the standard to improve functionality or to assemble with available retaining clips.

Dia	D	3	4	5	6	8	10	12	16	20	24
Head Dia	HD	4.5	6	8	10	14	18	20	25	30	36
Head Width	HW	1.2	1.5	1.6	2	3	4	4	4.5	5	6
Hole Dia	H	1.1	1.2	1.2	1.6	2	3.2	3.2	4	5	6.3
Hole Centre	HC	2.1	2.5	2.9	3.2	3.5	4.5	5.5	6	8	9

L \ D	3	4	5	6	8	10	12	16	20	24
10										
12										
16										
20										
25										
30										
35										
40										
50										
60										
70										
80										
90										
100										

Clevis Pins – Imperial



HUGE STOCKS

VOLUME DISCOUNT

STAINLESS STEEL

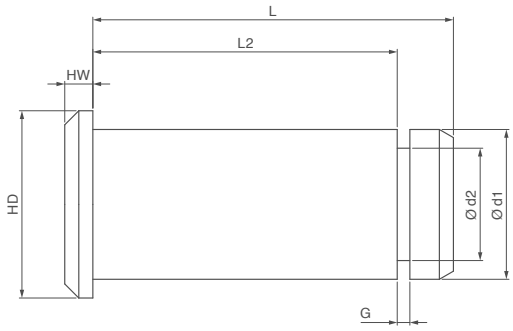
MATERIAL
/ Steel Bright Zinc Plated (CPZP) – Stainless Steel Type A2 (CPSS)

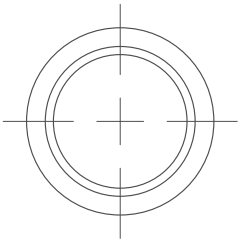
ORDERING INSTRUCTIONS
/ State CPSS for stainless steel or CPZP for Zinc Plated. When ordering give D x L

Dia	D	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Head Dia	HD	5/16"	3/8"	7/16"	1/2"	5/8"	11/16"	15/16"	1.3/16"
Head Width	HW	1/16"	3/32"	3/32"	1/8"	5/32"	13/64"	1/4"	11/32"
Hole Dia	H	0.078"	0.078"	0.104"	0.104"	0.135"	0.156"	0.156"	0.156"
Hole Centre	HC	0.100"	0.100"	0.140"	0.160"	0.160"	0.160"	0.160"	0.210"

L \ D	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
1/2								
5/8"								
3/4"								
1"								
1 1/4"								
1 1/2"								
1 3/4"								
2"								
2 1/4"								
2 1/2"								
2 3/4"								
3"								
3 1/4"								
3 1/2"								
3 3/4"								
4"								

Clevis Pins – Grooved Type





VOLUME DISCOUNT

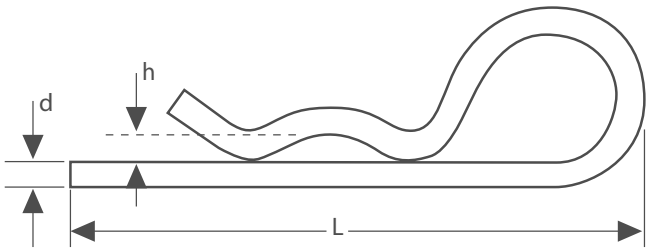
DESCRIPTION

Clevis Pin for use with fork ends and circlips, or retaining ring for quick release.

Part Reference	d1	L	L2	d2	HW	HD	G
NBM4	4	10.5	8.5	3.2	1	6	0.64
NBM5	5	13	10.5	4	1.5	8	0.74
NBM6	6	15.5	12.5	5	1.5	9	0.74
NBM8	8	20	16.5	6	2	12	0.94
NBM10	10	25	20.5	8	2.5	14	1.05
NBM12	12	30	24.5	9	3	16	1.15
NBM14	14	33	27.5	10	3	18	1.25
NBM16	16	38.5	32.5	12	3.5	20	1.35

R-Clips

Metric Bright Zinc Plated



HUGE STOCKS

VOLUME DISCOUNT

KEY FEATURES
- Single coil design
- Easy to use in production and field environments
- Bright zinc plated steel
- Use with Boneham Clevis Pins

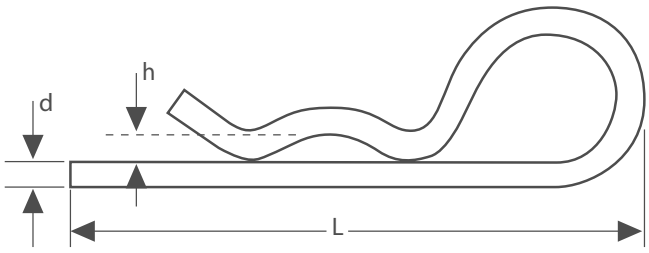
ORDERING INSTRUCTIONS
If using with a Boneham Clevis Pins, check compatibility of the pin from the clevis pin diameters on the right hand side of the table and pick corresponding part reference.

SINGLE COIL

Part Reference	d	H	L	For Clevis Pin
RC1.0BZP	1	2	20	3-5
RC1.2BZP	1.2	2	22	5-8
RC1.5BZP	1.6	2	26	6-10
RC2.0BZP	2	3	56	9-14
RC2.5BZP	2.5	4	48	9-14
RC3.0BZP	3	4.5	72	10-20
RC3.5BZP	3.5	6.57	76	16-25
RC4.5BZP	4.5	7	90	20-30
RC6.0BZP	6	8	124	28-40

R-Clips

Metric Stainless Steel



HUGE STOCKS

VOLUME DISCOUNT

STAINLESS STEEL

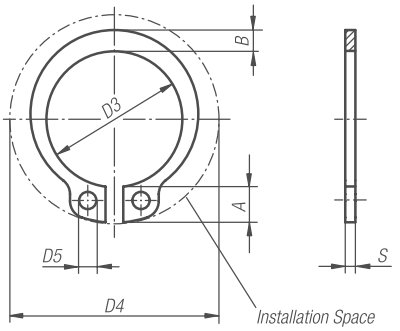
KEY FEATURES
- Single coil design
- Easy to use in production and field environments
- Stainless steel
- Use with Boneham Clevis Pins

ORDERING INSTRUCTIONS
If using with a Boneham Clevis Pins, check compatibility of the pin from the clevis pin diameters on the right hand side of the table and pick corresponding part reference.

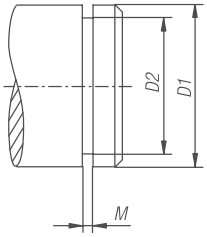
SINGLE COIL

Part Reference	d	H	L	For Clevis Pin
RC1.0SS	1	2	20	3-5
RC1.2SS	1.2	2	22	5-8
RC1.5SS	1.5	2	26	6-10
RC2.0SS	2	3	56	9-14
RC2.5SS	2.5	4	48	9-14
RC3.0SS	3	4.5	72	10-20
RC3.5SS	3.5	6.57	76	16-25
RC4.5SS	4.5	7	90	20-30
RC6.0SS	6	8	124	28-40

Circlips for Shafts

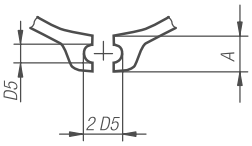


Assembly Dimensions



VOLUME DISCOUNT

D1 ≤ 9 mm



MATERIAL
/ Spring steel

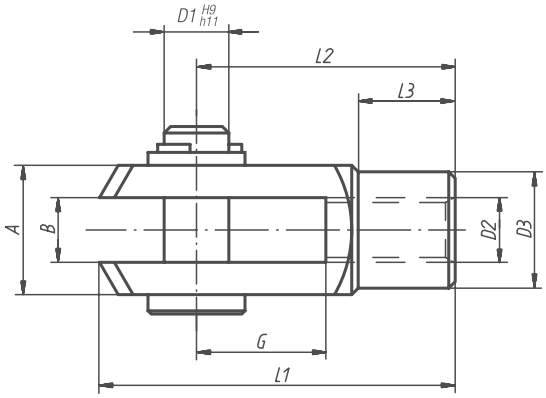
SURFACE FINISH
/ Phosphated

NOTES
The circlips per DIN 471 are universally usable, axially mountable securing elements for shafts. They can transmit large axial forces between the machine element (e.g. rolling-contact bearings) and the groove in which the ring is mounted.

Part Ref.	A	B	D1	D2	D3	D4	D5	M	S	Weight (g)
CC5MM	2,5	1,1	5	4,8	4,7	10,3	1	0,7	0,6	0,066
CC6MM	2,7	1,3	6	5,7	5,6	11,7	1,2	0,8	0,7	0,084
CC8MM	3,2	1,5	8	7,6	7,4	14,7	1,2	0,9	0,8	0,158
CC10MM	3,3	1,8	10	9,6	9,3	17	1,5	1,1	1	0,340
CC12MM	3,3	1,8	12	11,5	11	19	1,7	1,1	1	0,500
CC14MM	3,5	2,1	14	13,4	12,9	21,4	1,7	1,1	1	0,640
CC15MM	3,6	2,2	15	14,3	13,8	22,6	1,7	1,1	1	0,670
CC16MM	3,7	2,2	16	15,2	14,7	23,8	1,7	1,1	1	0,700

Clevis Pin Fork End

DIN 71751



VOLUME DISCOUNT

MATERIAL
/ Free-cutting steel

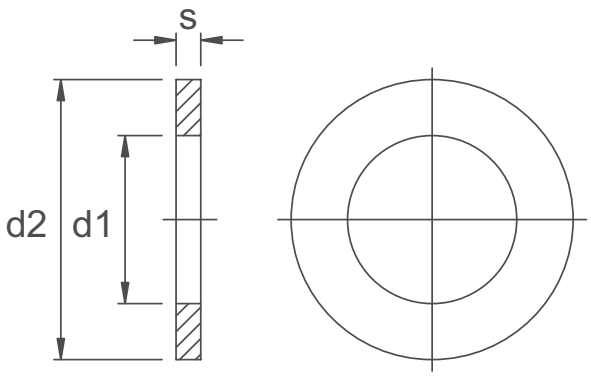
SURFACE FINISH
/ Galvanized

ON REQUEST
/ Left-handed thread

Part Ref.	Surface	Finish	B	G	D1	D2	D3	L1	L2	L3	A	Weight (g)
CPFE5MM	right-handed	thread	5	10	5	M5	9	26	20	7,5	10	10,0
CPFE6MM	right-handed	thread	6	12	6	M6	10	31	24	9	12	16,0
CPFE8MM	right-handed	thread	8	16	8	M8	14	42	32	12	16	38,0
CPFE10MM	right-handed	thread	10	20	10	M10	18	52	40	15	20	80,0
CPFE12MM	right-handed	thread	12	24	12	M12	20	62	48	18	24	125,0

Flat Washer

DIN 125



VOLUME DISCOUNT

STAINLESS STEEL

DESCRIPTION
Clevis Pin Spacing Washer: Metric

Clevis Pin Spacing Washer Zinc Plated

	Clevis Size	d1	d2	s
CPWZP 3MM	3mm	3.2mm	7mm	0.5
CPWZP 4MM	4mm	4.3mm	9mm	0.8
CPWZP 5MM	5mm	5.3mm	10mm	1
CPWZP 6MM	6mm	6.4mm	12mm	1.6
CPWZP 8MM	8mm	8.4mm	16mm	1.6
CPWZP 10MM	10mm	10.5mm	20mm	2
CPWZP 12MM	12mm	13mm	24mm	2.5
CPWZP 16MM	16mm	17mm	30mm	3

Clevis Pin Spacing Washer Stainless Steel

	Clevis Size	d1	d2	s
CPWSS 3MM	3mm	3.2mm	7mm	0.5
CPWSS 4MM	4mm	4.3mm	9mm	0.8
CPWSS 5MM	5mm	5.3mm	10mm	1
CPWSS 6MM	6mm	6.4mm	12mm	1.6
CPWSS 8MM	8mm	8.4mm	16mm	1.6
CPWSS 10MM	10mm	10.5mm	20mm	2
CPWSS 12MM	12mm	13mm	24mm	2.5
CPWSS 16MM	16mm	17mm	30mm	3

Special Parts to Customer Specification

Boneham & Turner Ltd's manufacturing plant has been the basis of its business since 1918 constantly improving machinery and passing on a wealth of experience through apprenticeships and dedicated long serving staff of up to 55 years. Customers know that when a drawing is passed to Boneham & Turner, they can expect the very best in precision engineered solutions and workmanship.

Areas of expertise

/ Turning
/ Milling
/ Internal Grinding / Honing
/ External Grinding

Specific Capabilities

/ Bar feed from 1mm upwards on multiple turning centres
/ Coil feed from 0.8mm to 6mm
/ Centreless grinding from 0.8mm
/ Internal grinding from 1.27mm
/ Cylindrical grinding
/ Plunge grinding from 3mm
/ CNC Milling with 4 axis capabilities

Boneham & Turner specialise in the manufacture of hardened and ground cylindrical components and welcome any drawing by fax +44 (0) 1623 445 451 or by email: sales@boneham.co.uk

BONEHAM USA Bushings – General Information

Standard Bushings

All of the bushings listed within this catalog are Boneham's range of standard sizes. The first section of this catalog contains our standard range of ANSI/ Boneham style bushings whose tolerances conform with the guidelines established by the American National Standards Institute (ANSI). Our range of standard bushing bores are those standard letter, number, and fractional sizes, in both drill and reamer tolerances, as defined by ANSI. For this range of bushings, selected millimeter bores from 2.3mm to 10.5mm, as designated by a box on the back cover, are also available as STANDARD. Any bore size not indicated as standard on the back cover is considered to be special. Our Sales Service Representatives will be glad to supply you with appropriate pricing for all specials.

The second section of this catalog offers our new range of "Total Metric" bushings. These dimensions and tolerances conform with the guidelines established by the International Standards Organization (ISO). Please refer to page 20 for ordering and technical information pertaining to these bushings.

Special Bushings

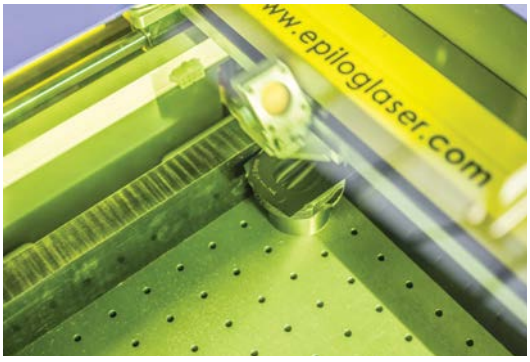
When required dimensions vary from the standard catalog listings of ID., O.D., Length, or Tolerance, the bushings are considered to be "specials". Many specials can be made from standard cataloged items by minor alterations. Others can be manufactured from standard bushing blanks. Some items are so completely different they must be custom made. Boneham is ready to manufacture all specials required – from the minor alteration to the complete "from scratch" special. Please forward your specifications, whether verbal, by sketch, or blueprint, along with your material requirements to our Sales Service Representatives for expeditious review and quotation.

Oversized Bushings

All ANSI/Boneham Press Fit and Liner type bushings in the first section of this catalog are available with oversize (unground) O.D.'s. When ordering, use the same ANSI symbol system as for Finish Ground bushings and add a "U" at the end of the bushing length designation. Please note that all bushings will be considered to be Finish Ground unless specifically designated as Oversize or Unground.

For Example:

An Oversize Headless Liner with a 1" ID., a 1-3/8" O.D., and a 2-1/8" length would be described as L-88-34U. No drill size is required since liners have one standard bore size for a specific O.D. Also the "drill or reamer" specifications are not required due to the fact that renewable bushings are inserted into liners.



Part Marking

The following chart details the O.D. tolerances for oversize bushings:

Nom. O.D.	O/S Tol.	Nom. O.D	O/S Tol.	Nom. O.D.	O/S Tol.
5/32	.166 .161	1/2	.520 .515	1-3/8	1.395 1.390
3/16	.198 .193	9/16	.582 .577	1-1/2	1.520 1.515
13/64	.213 .208	5/8	.645 .640	1-5/8	1.645 1.640
1/4	.260 .255	3/4	.770 .765	1-3/4	1.770 1.765
5/16	.327 .322	7/8	.895 .890	1-7/8	1.895 1.890
3/8	.393 .388	1	1.020 1.015	2-1/4	2.270 2.265
13/32	.421 .416	1-1/8	1.145 1.140	2-3/4	2.770 2.765
7/16	.455 .450	1-1/4	1.270 1.265		

Guarantee

Boneham Metal Products, Inc. Drill Bushings are guaranteed against defects in materials or workmanship. The tolerances of our products are guaranteed to conform to either ANSI, ISO, or catalog standards.

Boneham cannot accept returns or cancellations on special parts.

Ordering Information

ANSI/BMP Bushings

For ordering information on ISO style Total Metric Bushings, please see page 33.

For ANSI/Boneham style bushings please supply the following information:
/ Bushing TYPE
/ OUTSIDE DIAMETER
/ Bushing LENGTH
/ INSIDE DIAMETER
/ Whether for a DRILL or REAMER

The bushings in this section of the catalog are defined by the ANSI Symbol System. This system is applied as follows:

Example Number 1:

A Headless Press Fit bushing with a 1/2" OD., a length of 3/4", a 1/4" bore, and to be used for drilling, would be described as:

P-32-12, 1/4, DRILL

- DRILL — For use in DRILLING or REAMING
- 1/4 — INSIDE DIAMETER
- 12 — LENGTH in increments of 1/16 of an inch*
- 32 — OUTSIDE DIAMETER in increments of 1/64 of an inch
- P — Bushing TYPE/SYMBOL

*This is overall for headless press fit and all liner bushings and the "under-head" length for all head type press fit and renewable bushings.

Example Number 2:

A Slip-Fixed Renewable bushing with a 7/16" OD., a length of 1/2", a bore of 3mm, and to be used for Reaming, would be described as:

SF-TW-28-8, 3mm, REAMER

Bushing Type Designation

Bushing Type	ANSI/BMP Letter Designation	Thinwall Letter Designation
Headless Press Fit	P	P-TW
Head Press Fit	H	H-TW
Slip Fixed Renewable	SF	SF-TW
Headless Liner	L	L-TW
Head Type Liner	HL	-
Headless Metric	PM	-
Head Metric	HM	-
Serrated Press	SP	-
Serrated Press Metric	SPM	-
Diamond Groove	DG	-
Diamond Groove Metric	DGM	-
Slip Fixed Renewable Metric	SFM	-
U-Lock Liner	UL	-

Prices

ANSI/Boneham style bushings have the ANSI bushing symbol and Boneham price code in each identification box located in the charts on the following pages.
/ Please see separate price list for Boneham Standard Bushing Steel bushings.
/ Boneham NITRALLOY Nitrided drill bushings will be quoted upon request.
/ Please note that all prices may be subject to change without notice.

Technical Information

ANSI/BMP Bushings

Boneham Bushing Materials

1. Standard Boneham Drill Bushings (over .0400" bore) are manufactured from steel which demonstrates excellent wear resistance and dimensional stability characteristics. This material is "hardened" to Rc 62-64.

2. All Boneham Drill Bushings (.0625 bore and over), are offered in our Premium alloy NITRALLOY. Boneham NITRALLOY Nitrided Drill Bushings are "case hardened" to a case depth of .013" to Rc 67-69 equivalent. Hardness must be checked by using the 15Kg. Superficial Rockwell Scale. NITRALLOY Nitrided drill bushings demonstrate superior wear resistance and dimensional stability characteristics.

3. Our Sales Service Representatives will be glad to provide you with a quotation on those bushings which have material requirements that are different from our standard materials, ie. M-2 HSS, Stainless Steel, O-6 Tool Steel, Carbide.

Bushing Body Characteristics

Entrance End

The entrance end of each Boneham Drill Bushing has a "blended radius". This permits easier tool entry and assistance in guiding the drill in cases of minor drill/drill bushing misalignment.

Counterbores

Any drill bushing with either a "small" bore, or with a "large" drill bushing length-to-bore ratio, is counterbored. This is to provide assistance with lubrication supply to the drill point, as well as expedient removal of chips. Those drill bushings that have standard counterbores are designated with either a • or †.

Please note that all drill bushings with standard counterbores can be supplied without counterbores. Our Sales Service Representatives will be glad to provide you with a quotation as per your requirements.

Chamfers/Leads

All Press Fit Bushings and Liners ground to Press Fit tolerances are supplied with a chamfer and ground concentric lead on the O.D. of the exit end. This chamfer/lead combination provides assistance by "starting" the bushing into the hole, resulting in easier insertion.

Bushing Bore Tolerances

For Ansi/BMP Standard and Thinwall Bushings for DRILLS

Bushing Type	Bore Tolerance Over Nominal
from .0135" to .2500"	+.0001" –+.0004"
over. 2500" to 7500"	+.0001" –+.0005"
over. 7500" to 1.500"	+.0002" –+.0006"
over. 1.5000" to 1.8750"	+.0003" –+.0007"

For ANSI/BMP Standard and Thinwall Bushings for REAMERS

Normal Bushing Bore	Bore Tolerance Over Nominal
from .0135" to .2500"	+.0005" –+.0008"
over. 2500" to 1.0000"	+.0006" –+.0010"
over. 1.0000"	+.0008" –+.0012'

Concentricity Tolerances

Bores up to .5000"	.0003" T.I.R max
Bores over .5000"	.0005" T.I.R max
Metric Bores	.012mm T.I.R max

For ANSI/BMP Standard Drill Bushings

All Bore sizes	.0005" T.I.R max

For Thinwall Drill Bushings
Please note that on Counterbored Drill Bushings, these concentricity specifications apply to the exit end of the bushing.

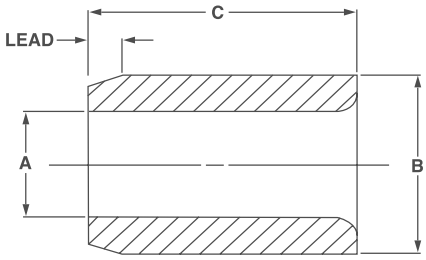
Bore Tolerances for ANSI Metric Bushings (G6)

Metric Sizes	Tolerance
.35 to 3.00	+.002 / +.008
3.01 to 6.00	+.004 / +.012
6.01 to 10.00	+.005 / +.014
10.01 to 18.00	+.006 / +.017
18.01 to 30.00	+.007 / +.020
30.01 to 50.00	+.009 / +.025
50.01 to 55.00	+.010 / +.029

Metric Reamer Sizes	Tolerance
1.00 to 3.00	+.006 / +.012
3.01 to 6.00	+.010 / +.018
6.01 to 10.00	+.013 / +.022
10.01 to 18.00	+.016 / +.027
18.01 to 30.00	+.020 / +.033

Headless Press Fit Drill Bushings

P Type ANSI Drill Bushings



VOLUME DISCOUNT

KEY FEATURES
- / Diameters from 0.0156 to 1.7656
- / Hardened to 60-65 HRC
- / OD lead for easy installation
- / ID radius improves drill entry
- / OD ground to press fit size

APPLICATION
The 'P Type' drill bushing is normally used in jigs where an economically priced drill bushing is required, or where less space is available on the jig plate. Headless press fit bushings are pressed into the plate to achieve a flush surface in conjunction with a simple drilling and reaming operation.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size and whether it's a Drill or Reamer. Example: 6, P-40-8-5/16

NOTES
- / For general ordering information and technical data see pages 97-98
- / To order Oversize Bushings; suffix symbol with the letter U Example: P-40-8U-5/16
- / Nitralloy Bushings quoted upon request
- / Price list codes detailed below; please see price list.

Bore Size A*	Outside Diameter B		C: Bushing Length and Price Code Number											
			Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"
0.0135 to 0.0280	5/32	0.1578 0.1575	P	-10-4 POA	-10-5 POA	-10-6 POA	-10-8 POA	-10-12 POA						
0.0292 to 0.0591	5/32	0.1578 0.1575	P	-10-4 POA	-10-5 POA	-10-6 POA	-10-8† POA	-10-12† POA						
0.0595 to 0.0625	5/32	0.1578 0.1575	P	-10-4 206	-10-5 210	-10-6 212	-10-8 213	-10-12• 222						
0.0135 to 0.0280	13/64	0.2046 0.2043	P	-13-4 POA	-13-5 POA	-13-6 POA	-13-8 POA	-13-12 POA						
0.0292 to 0.0591	13/64	0.2046 0.2043	P	-13-4 POA	-13-5 POA	-13-6 POA	-13-8† POA	-13-12† POA						
0.0595 to 0.0625	13/64	0.2046 0.2043	P	-13-4 206	-13-5 210	-13-6 212	-13-8 213	-13-12• 222	-13-16• 237					
0.0635 to 0.0995	13/64	0.2046 0.2043	P	-13-4 138	-13-5 146	-13-6 152	-13-8 153	-13-12• 161	-13-16• 169	-13-22• 195				
0.0980 to 0.1406	1/4	0.2516 0.2513	P	-16-4 134	-16-5 137	-16-6 142	-16-8 146	-16-12 155	-16-16• 164	-16-22• 209	-16-28• 219			
0.1250 to 0.1935	5/16	0.3141 0.3138	P	-20-4 123	-20-5 126	-20-6 129	-20-8 130	-20-12 135	-20-16 140	-20-22• 169	-20-28• 201			
0.1875 to 0.2570	13/32	0.4078 0.4075	P	-26-4 118	-26-5 119	-26-6 122	-26-8 123	-26-12 129	-26-16 137	-26-22• 146	-26-28• 164			

Continued on next page

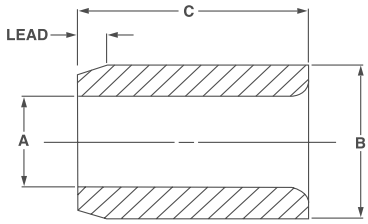
Headless Press Fit Drill Bushings

Bore Size A*	Outside Diameter B		C: Bushing Length and Price Code Number											
			Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"
0.1875 to 0.3160	1/2	0.5017 0.5014	P	-32-4 118	-32-5 119	-32-6 122	-32-8 123	-32-12 129	-32-16 137	-32-22• 146	-32-28• 164			
0.3125 to 0.4375	5/8	0.6267 0.6264	P	-40-4 123	-40-5 118	-40-6 120	-40-8 120	-40-12 123	-40-16 126	-40-22 146	-40-28 155	-40-34 170	-40-40 290	
0.3125 to 0.5312	3/4	0.7518 0.7515	P	-48-4 126	-48-5 119	-48-6 123	-48-8 123	-48-12 126	-48-16 130	-48-22 145	-48-28 158	-48-34 174	-48-40 235	
0.5000 to 0.6562	7/8	0.8768 0.8765	P		-56-5 138	-56-6 140	-56-8 134	-56-12 135	-56-16 138	-56-22 144	-56-28 159	-56-34 170	-56-40 191	-56-48 292
0.5000 to 0.7656	1	1.0018 1.0015	P				-64-8 135	-64-12 135	-64-16 139	-64-22 144	-64-28 161	-64-34 170	-64-40 191	-64-48 252
0.6250 to 1.0312	1-3/8	1.3772 1.3768	P				-88-8 170	-88-12 155	-88-16 170	-88-22 189	-88-28 201	-88-34 213	-88-40 225	-88-48 305
1.1000 to 1.3906	1-3/4	1.7523 1.7519	P					-112-12 196	-112-16 189	-112-22 196	-112-28 206	-112-34 222	-112-40 235	-112-48 329
1.3750 to 1.7656	2-1/4	2.2525 2.2521	P						-144-16 207	-144-22 218	-144-28 227	-144-34 272	-144-40 299	-144-48 342

* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES. MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by on back cover.
• COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.
† COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.
*Price on Application, prices subject to change.

Headless Press Fit Drill Bushings

PM Type ANSI Metric Bushings



VOLUME DISCOUNT

KEY FEATURES
/ Diameters from 1.50mm to 105mm
/ Hardened to 60-65 HRC
/ OD lead for easy installation
/ ID radius improves drill entry
/ OD ground to press fit size

APPLICATION
The 'PM Type' drill bushing is normally used in jigs where an economically priced drill bushing is required, or where less space is available on the jig plate. Headless press fit bushings are pressed into the plate to achieve a flush surface in conjunction with a simple drilling and reaming operation.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size and whether it's a Drill or Reamer.
Example: 6, PM-10-10-6MM

NOTES
/ For general ordering information and technical data see pages 97-98
/ To order Oversize Bushings; suffix symbol with the letter U. Example: PM-4-7U-12
/ Nitralloy Bushings quoted upon request
/ Price list codes detailed below; please see price list.

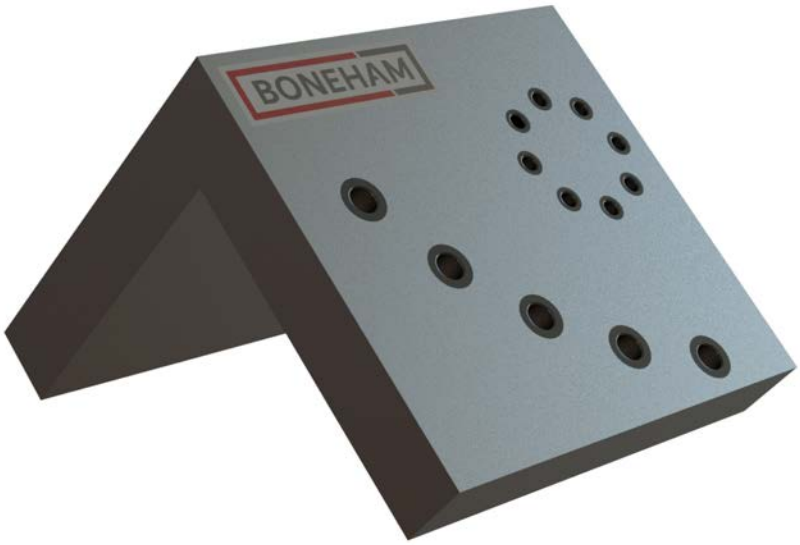
Bore Size Range From - To A (mm)	Outside Diameter B (mm)	C (mm): Headless Press Fit & Liners (PM & LM) Symbol: Type - OD - Length											
		Prefix	8mm	10mm	12mm	16mm	20mm	25mm	28mm	36mm	45mm	56mm	67mm
1.500 - 1.800 1.801 - 2.600		PM	POA	POA	POA	POA	POA	POA	POA	POA	POA	POA	POA
2.601 - 3.300	6 6.027-6.019	PM	-6-8 166		-6-12 183	-6-16 191							
3.301 - 4.000	7 7.032-7.023	PM	-7-8 148		-7-12 156	-7-16 166							
4.001 - 5.000	8 8.032-8.023	PM	-8-8 148		-8-12 156	-8-16 166							
5.001 - 6.000	10 10.032-10.023	PM		-10-10 139		-10-16 143	-10-20 152						
6.001 - 8.000	12 12.039-12.028	PM		-12-10 139		-12-16 143	-12-20 152						
8.001 - 10.000	15 15.039-15.028	PM			-15-12 137		-15-20 143	-15-25 148					
10.001 - 12.000	18 18.039-18.028	PM			-18-12 143		-18-20 148	-18-25 156					
12.001 - 15.000	22 22.048-22.035	PM				-22-16 161			-22-28 167	-22-36 189			
15.001 - 18.000	26 26.048-26.035	PM				-26-16 161			-26-28 168	-26-36 191			
18.001 - 22.000	30 30.048-30.035	PM					-30-20 161			-30-36 191	-30-45 199		
22.001 - 26.000	35 35.059-35.043	PM					-35-20 192			-35-36 226	-35-45 235		
26.001 - 30.000	42 42.059-42.043	PM						-42-25 217			-42-45 273	-42-56 318	

*Price on Application, prices subject to change.

Continued on next page

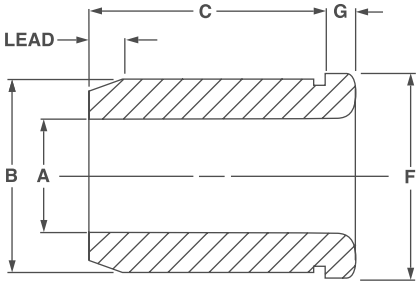
Headless Press Fit Drill Bushings

Bore Size Range From - To A (mm)	Outside Diameter B (mm)	C (mm): Headless Press Fit & Liners (PM & LM) Symbol: Type - OD - Length											
		Prefix	8mm	10mm	12mm	16mm	20mm	25mm	28mm	36mm	45mm	56mm	67mm
30.001 - 35.000	48 48.059-48.043	PM						-48-35 217			-48-45 274	-48-56 318	
35.001 - 42.000	55 55.072-55.053	PM						-55-30 303				-55-56 341	-55-67 358
42.001 - 48.000 48.001 - 55.000 55.001 - 63.000 63.001 - 78.000			POA	POA	POA	POA	POA	POA	POA	POA	POA	POA	POA



Head Press Fit Drill Bushings

H Type ANSI Drill Bushings



VOLUME DISCOUNT

KEY FEATURES
- / Diameters from 0.0156 to 1.7656
- / Hardened to 60-65 HRC
- / OD lead for easy installation
- / ID radius improves drill entry
- / OD ground to press fit size

APPLICATION
The 'H Type' drill bushing features a head which allows for greater axial force, so not to slip out the plate, or to feed down to a dead stop if required. The head of the bush also allows it to be pressed into the plate easier and can be left either exposed above the plate surface or counterbored to sit flush.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size and whether it's a Drill or Reamer. Example: 6, H-40-8-5/16

NOTES
- / For general ordering information and technical data see pages 97-98
- / To order Oversize Bushings; suffix symbol with the letter U. Example: H-40-8U-5/16
- / Nitralloy Bushings quoted upon request
- / Price list codes detailed below; please see price list.

Bore Size A*	Outside Diameter B		C: Length Under Head and Price Code Number												Head Dia. F	Head Thk. G
			Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"		
0.0135 to 0.0280	5/32	0.1578 0.1575	H	-10-4 POA	-10-5 POA	-10-6 POA	-10-8 POA	-10-12• POA							1/4	3/32
0.0292 to 0.0591	5/32	0.1578 0.1575	H	-10-4 POA	-10-5 POA	-10-6 POA	-10-8† POA	-10-12• POA							1/4	3/32
0.0595 to 0.0625	5/32	0.1578 0.1575	H	-10-4 211	-10-5 212	-10-6 213	-10-8† 214	-10-12• 226							1/4	3/32
0.0135 to 0.0280	13/64	0.2046 0.2043	H	-13-4 POA	-13-5 POA	-13-6 POA	-13-8 POA	-13-12† POA							19/64	3/32
0.0292 to 0.0591	13/64	0.2046 0.2043	H	-13-4 POA	-13-5 POA	-13-6 POA	-13-8† POA	-13-12† POA							19/64	3/32
0.0595 to 0.0625	13/64	0.2046 0.2043	H	-13-4 211	-13-5 212	-13-6 213	-13-8• 214	-13-12• 226	-13-16• 264						19/64	3/32
0.0635 to 0.0995	13/64	0.2046 0.2043	H	-13-4 158	-13-5 159	-13-6 164	-13-8 167	-13-12• 187	-13-16• 205	-13-22• 264					19/64	3/32
0.0980 to 0.1406	1/4	0.2516 0.2513	H	-16-4 158	-16-5 152	-16-6 155	-16-8 158	-16-12 183	-16-16• 207	-16-22• 252					23/64	3/32
0.1250 to 0.1935	5/16	0.3141 0.3138	H	-20-4 134	-20-5 137	-20-6 140	-20-8 142	-20-12 144	-20-16• 159	-20-22• 210	-20-28• 223				27/64	1/8
0.1875 to 0.2570	13/32	0.4078 0.4075	H	-26-4 129	-26-5 130	-26-6 135	-26-8 137	-26-12 140	-26-16• 153	-26-22• 164	-26-28• 190				1/2	5/32

Continued on next page

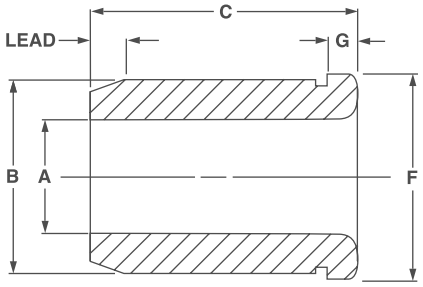
Head Press Fit Drill Bushings

Bore Size A*	Outside Diameter B		C: Length Under Head and Price Code Number												Head Dia. F	Head Thk. G
			Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"		
0.1875 to 0.3160	1/2	0.5017 0.5014	H	-32-4 129	-32-5 130	-32-6 135	-32-8 137	-32-12 140	-32-16 153	-32-22• 165	-32-28• 190				39/64	7/32
0.3125 to 0.4375	5/8	0.6267 0.6264	H	-40-4 135	-40-5 129	-40-6 130	-40-8 130	-40-12 135	-40-16 140	-40-22 164	-40-28 183	-40-34 194			51/64	7/32
0.3125 to 0.5312	3/4	0.7518 0.7515	H	-48-4 140	-48-5 134	-48-6 135	-48-8 135	-48-12 140	-48-16 146	-48-22 167	-48-28 186	-48-34 196			59/64	7/32
0.5000 to 0.6562	7/8	0.8768 0.8765	H				-56-8 149	-56-12 151	-56-16 153	-56-22 161	-56-28 189	-56-34 196	-56-40 212		1-7/64	1/4
0.5000 to 0.7656	1	1.0018 1.0015	H				-64-8 152	-64-12 152	-64-16 158	-64-22 164	-64-28 193	-64-34 206	-64-40 221	-64-48 318	1-15/64	5/16
0.6250 to 1.0312	1-3/8	1.3772 1.3768	H				-88-8 199	-88-12 192	-88-16 200	-88-22 208	-88-28 222	-88-34 237	-88-40 291	-88-48 335	1-39/64	3/8
1.1000 to 1.3906	1-3/4	1.7523 1.7519	H					-112-12 227	-112-16 217	-112-22 227	-112-28 240	-112-34 294	-112-40 307	-112-48 347	1-63/64	3/8
1.3750 to 1.7656	2-1/4	2.2525 2.2521	H						-144-16 276	-144-22 302	-144-28 322	-14434 332	-144-40 339	-144-48 357	2-31/64	3/8

* Standard bore sizes available are per chart shown in rear of catalog – including LETTER, NUMBER and FRACTIONAL SIZES. MILLIMETER – from 2.3 mm to 10.5 mm only for selected list designated by on back cover.
• COUNTERBORED – with adequate bearing length – can also be supplied without counterbore upon request.
† COUNTERBORED – 0.0390 to 0.0469 with adequate bearing length; can also be supplied without counterbore upon request.
*Price on Application, prices subject to change.

Head Press Fit Drill Bushings

HM Type ANSI Metric Bushings



VOLUME DISCOUNT

KEY FEATURES
/ Diameters from 1.50mm to 105mm
/ Hardened to 60-65 HRC
/ OD lead for easy installation
/ ID radius improves drill entry
/ OD ground to press fit size

APPLICATION
The 'HM Type' drill bushing features a head which allows for greater axial force, so not to slip out the plate, or to feed down to a dead stop if required. The head of the bush also allows it to be pressed into the plate easier and can be left either exposed above the plate surface or counterbored to sit flush.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size and whether it's a Drill or Reamer.
Example: 6, HM-10-10-6MM

NOTES
/ For general ordering information and technical data see pages 97-98
/ To order Oversize Bushings; suffix symbol with the letter U. Example: HM-10-10U-6MM
/ Nitralloy Bushings quoted upon request
/ Price list codes detailed below; please see price list.

Bore Size Range From - To A (mm)	Outside Diameter B (mm)	C (mm): Headed Press Fit & Liners (HM & HLM) Symbol: Type - OD - Length												F	G
		Prefix	8mm	10mm	12mm	16mm	20mm	25mm	28mm	36mm	45mm	56mm	67mm		
1.500 - 1.800 1.801 - 2.600		HM	POA	POA	POA	POA	POA	POA	POA	POA	POA	POA	POA		2
2.601 - 3.300	6 6.027-6.019	HM	-6-8 190		-6-12 193	-6-16 211								9	2.5
3.301 - 4.000	7 7.032-7.023	HM	-7-8 161		-7-12 170	-7-16 185								10	2.5
4.001 - 5.000	8 8.032-8.023	HM	-8-8 161		-8-12 170	-8-16 185								11	2.5
5.001 - 6.000	10 10.032- 10.023	HM		-10-10 161		-10-16 169	-10-20 208							13	3
6.001 - 8.000	12 12.039- 12.028	HM		-12-10 161		-12-16 169	-12-20 191							15	3
8.001 - 10.000	15 15.039- 15.028	HM			-15-12 156		-15-20 169	-15-25 170						18	3
10.001 - 12.000	18 18.039- 18.028	HM			-18-12 161		-18-20 169	-18-25 185						22	4
12.001 - 15.000	22 22.048- 22.035	HM				-22-16 190			-22-28 199	-22-36 206				26	4
15.001 - 18.000	26 26.048- 26.035	HM				-26-16 190			-26-28 194	-26-36 213				30	4

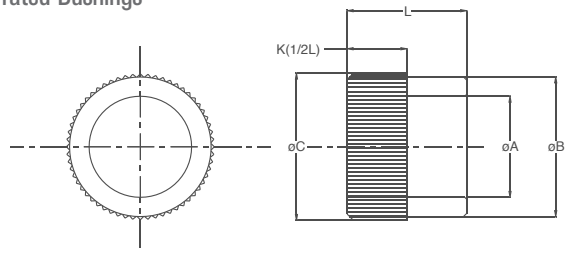
Continued on next page

Head Press Fit Drill Bushings

Bore Size Range From - To A (mm)	Outside Diameter B (mm)	C (mm): Headed Press Fit & Liners (HM & HLM) Symbol: Type - OD - Length												F	G
		Prefix	8mm	10mm	12mm	16mm	20mm	25mm	28mm	36mm	45mm	56mm	67mm		
18.001 - 22.000	30 30.048-30.035	HM					-30-20 221			-30-36 294	-30-45 304			34	5
22.001 - 26.000	35 35.059-35.043	HM					-35-20 223			-35-36 296	-35-45 305			39	5
26.001 - 30.000	42 42.059-42.043	HM						-42-25 300			-42-45 305	-42-56 349		46	5
30.001 - 35.000	48 48.059-48.043	HM						-48-35 304			-48-45 327	-48-56 348		52	5
35.001 - 42.000	55 55.072-55.053	HM						-55-30 342				-55-56 359	-55-67 360	59	5
42.001 - 48.000															
48.001 - 55.000			POA	POA	POA	POA	POA	POA	POA	POA	POA	POA	POA		
55.001 - 63.000															
63.001 - 78.000															

Serrata Press Fit Drill Bushings

SP Type Serrated Bushings



VOLUME DISCOUNT

C = B + (0.014" to 0.020")

KEY FEATURES
/ Diameters from 0.0595 to 0.7656
/ ID Hardened to 60-65 HRC
/ ID radius improves drill entry
/ Top OD serrated
/ Bottom ID ground

APPLICATION
The 'SP Type' drill bushing is similar to that of the 'P Type' bushing, they are designed to press into soft materials, such as wood and soft metals. The top of the OD is serrated to prevent rotational movement and increased axial resistance in the jig. The rest of the bushing is finish ground to allow for accurate and easy location.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size. Example: SP-5/16-3/4-1/2
If ordering specials, state ID, OD and Length.

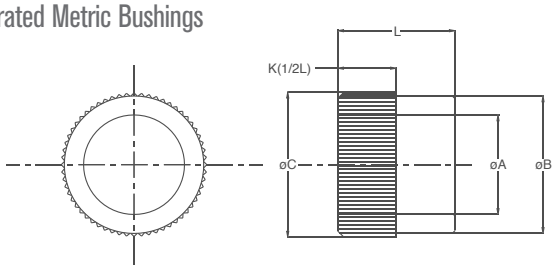
NOTES
/ For general ordering information and technical data see pages 97-98
/ Price list codes detailed below; please see price list.

Bore Size Range A	Outside Diameter B		Prefix	Bushing Length L, Code Number & $ L						
	Size	Tolerance		1/4	5/16	3/8	1/2	3/4	1	1-3/8
0.0595 0.0709	13/64	0.2031 0.2029	SP	13-4 POA	13-5 POA	13-6 POA	13-8 POA			
0.0709 0.0995	13/64	0.2031 0.2029	SP	13-4 167	13-5 187	13-6 190	13-8 191			
0.0980 0.1181	1/4	0.2500 0.2498	SP	16-4 146	16-5 152	16-6 157	16-8 161			
0.1181 0.1406	1/4	0.2500 0.2498	SP	16-4 146	16-5 152	16-6 157	16-8 161			
0.1250 0.1935	5/16	0.3125 0.3123	SP	20-4 137	20-5 137	20-6 139	20-8 143	20-12 150		
0.1562 0.1969	13/32	0.4062 0.4060	SP	26-4 127	26-5 128	26-6 131	26-8 134	26-12 139	26-16 152	
0.1969 0.2362	13/32	0.4062 0.4060	SP	26-4 127	26-5 128	26-6 131	26-8 134	26-12 139	26-16 152	
0.2362 0.2570	13/32	0.4062 0.4060	SP	26-4 127	26-5 128	26-6 131	26-8 134	26-12 139	26-16 152	
0.1562 0.2362	1/2	0.5000 0.4998	SP		32-5 128	32-6 131	32-8 134	32-12 139	32-16 152	
0.2362 0.3160	1/2	0.5000 0.4998	SP		32-5 128	32-6 131	32-8 134	32-12 139	32-16 152	
0.3125 0.4375	5/8	0.6250 0.6248	SP			40-6 129	40-8 129	40-12 134	40-16 137	
0.3125 0.5000	3/4	0.7500 0.7498	SP			48-6 134	48-8 134	48-12 137	48-16 143	
0.5000 0.5312	3/4	0.7500 0.7498	SP			48-6 134	48-8 134	48-12 137	48-16 143	
0.5000 0.6562	7/8	0.8750 0.8748	SP			56-6 154	56-8 146	56-12 150	56-16 152	
0.5000 0.7656	1	1.0000 0.9998	SP				64-8 150	64-12 150	64-16 153	64-22 159

*Price on Application, prices subject to change.

Serrata Press Fit Drill Bushings

SPM Type Serrated Metric Bushings



VOLUME DISCOUNT

C = B + (0.35 to 0.5 mm)

KEY FEATURES
/ Diameters from 1.20mm to 18mm
/ ID Hardened to 60-65 HRC
/ ID radius improves drill entry
/ Top OD serrated
/ Bottom ID ground

APPLICATION
The 'SPM Type' drill bushing is similar to that of the 'P Type' bushing, they are designed to press into soft materials, such as wood and soft metals. The top of the OD is serrated to prevent rotational movement and increased axial resistance in the jig. The rest of the bushing is finish ground to allow for accurate and easy location.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size. Example: 6, SPM-7-16-4MM
If ordering specials, state ID, OD and Length.

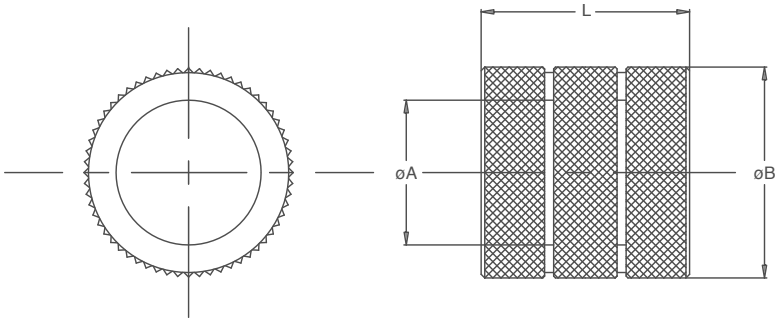
NOTES
/ For general ordering information and technical data see pages 97-98
/ Price list codes detailed below; please see price list.

Bore Size A (mm) F7		OD B (mm)	OD B Tolerance (mm)	Length L (mm)	Part Code	Price Code
From	To					
1.20	1.8	5	5.000/4.995	6	SPM-5-6	POA
				9	SPM-5-9	POA
1.81	2.6	5	5.000/4.995	6	SPM-5-6	187
				9	SPM-5-9	198
2.61	3.3	6	6.000/5.995	8	SPM-6-8	160
				12	SPM-6-12	187
				16	SPM-6-16	190
3.31	4	7	7.000/6.995	8	SPM-7-8	143
				12	SPM-7-12	152
				16	SPM-7-16	159
4.01	5	8	8.000/7.994	8	SPM-8-8	143
				12	SPM-8-12	152
				16	SPM-8-16	159
5.01	6	10	10.000/9.994	10	SPM-10-10	139
				16	SPM-10-16	148
				20	SPM-10-20	159
6.01	8	12	12.000/11.992	10	SPM-12-10	139
				16	SPM-12-16	148
				20	SPM-12-20	159
8.01	10	15	15.000/14.992	12	SPM-15-12	134
				20	SPM-15-20	143
				25	SPM-15-25	148
10.01	12	18	18.000/17.992	12	SPM-18-12	139
				20	SPM-18-20	152
				25	SPM-18-25	160
12.01	15	22	22.000/21.991	16	SPM-22-16	159
				28	SPM-22-28	161
				36	SPM-22-36	170
15.01	18	26	26.000/25.991	16	SPM-26-16	159
				28	SPM-26-28	161
				36	SPM-26-36	170

* Price on Application, prices subject to change.

Diamond Groove Drill Bushings

DG Type 'Cast-in' Bushings



VOLUME DISCOUNT

KEY FEATURES
/ Diameters from 0.0595 to 0.7656
/ ID Hardened to 60-65 HRC
/ ID radius improves drill entry
/ OD diamond knurling

APPLICATION
The 'DG Type' drill bushing is designed to be cast in the fixture or mold. Popular in the resin and composite industries as the composite runs through the grooves to lock the bushing in place. The groove and the diamond knurling are highly resistant to axial and rotational movement.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size. Example: 6, DG-20-5-1/8
If ordering specials, state ID, OD and Length.

NOTES
/ For general ordering information and technical data see pages 97-98
/ Price list codes detailed below; please see price list.

Bore Size Range A	Outside Diameter B		Prefix	Bushing Length L And Price Code Numbers L							
	Size	Tolerance		1/4	5/16	3/8	1/2	3/4	1	1-3/8	1-1/2
0.0595 0.0709	13/64	0.2230 0.2130	DG	13-4 POA	13-5 POA	13-6 POA	13-8 POA				
0.0709 0.0995	13/64	0.2230 0.2130	DG	13-4 152	13-5 153	13-6 156	13-8 159				
0.0980 0.1181	1/4	0.2750 0.2600	DG	16-4 129	16-5 130	16-6 134	16-8 135	16-12 145			
0.1181 0.1406	1/4	0.2750 0.2600	DG	16-4 129	16-5 130	16-6 134	16-8 135	16-12 145			
0.1250 0.1935	5/16	0.3370 0.3220	DG	20-4 115	20-5 116	20-6 117	20-8 118	20-12 120	20-16 129		
0.1562 0.1969	13/32	0.4310 0.4160	DG	26-4 115	26-5 115	26-6 116	26-8 117	26-12 118	26-16 120		

Continued on next page

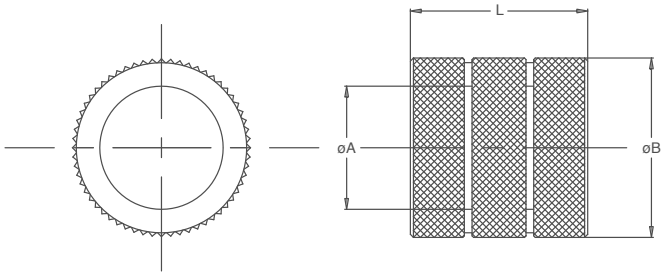
Diamond Groove Drill Bushings

Bore Size Range A	Outside Diameter B		Prefix	Bushing Length L And Price Code Numbers L							
	Size	Tolerance		1/4	5/16	3/8	1/2	3/4	1	1-3/8	1-1/2
0.1969 0.2362	13/32	0.4310 0.4160	DG	26-4 115	26-5 115	26-6 116	26-8 117	26-12 118	26-16 120		
0.2362 0.2570	13/32	0.4310 0.4160	DG	26-4 115	26-5 115	26-6 116	26-8 117	26-12 118	26-16 120		
0.1562 0.2362	1/2	0.5250 0.5100	DG		32-5 115	32-6 116	32-8 117	32-12 118	32-16 120		
0.2362 0.3160	1/2	0.5250 0.5100	DG		32-5 115	32-6 116	32-8 117	32-12 118	32-16 120		
0.3125 0.4375	5/8	0.6500 0.6350	DG			40-6 115	40-8 116	40-12 117	40-16 118	40-22 120	
0.3125 0.5000	3/4	0.7750 0.7600	DG			48-6 115	48-8 116	48-12 117	48-16 118	48-22 139	
0.5000 0.5312	3/4	0.7750 0.7600	DG			48-6 115	48-8 116	48-12 117	48-16 118	48-22 139	
0.5000 0.6562	7/8	0.9000 0.8850	DG			56-6 138	56-8 131	56-12 132	56-16 134	56-22 139	
0.5000 0.7656	1	1.0350 1.0100	DG				64-8 132	64-12 132	64-16 135	64-22 137	64-24 151

*Price on Application, prices subject to change.

Diamond Groove Drill Bushings

DGM Type METRIC 'Cast-in Bushings'



VOLUME DISCOUNT

KEY FEATURES
- / Diameters from 1.20mm to 18mm
- / ID Hardened to 60-65 HRC
- / ID radius improves drill entry
- / OD diamond knurling

APPLICATION
The 'DGM Type' drill bushing is designed to be cast in the fixture or mold. Popular in the resin and composite industries as the composite runs through the grooves to lock the bushing in place. The groove and the diamond knurling are highly resistant to axial and rotational movement.

ORDERING INSTRUCTIONS
When Ordering State: Quantity, Symbol, Bore Size.
Example: DGM-6-12-3MM
If ordering specials, state ID, OD and Length.

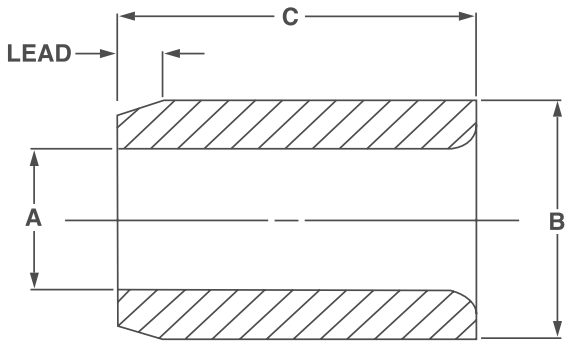
NOTES
- / For general ordering information and technical data see pages 97-98
- / Price list codes detailed below; please see price list.

Bore Size A (mm) F7		OD B (mm)	OD B Tolerance (mm)	Length L (mm)	Part Code	No. of Grooves	Price Code
From	To						
1.20	1.8	5	5.50/5.25	6	DGM-5-6	1	POA
				9	DGM-5-9	1	POA
1.80	2.6	5	5.50/5.25	6	DGM-5-6	1	187
				9	DGM-5-9	1	198
2.61	3.3	6	6.65/6.25	8	DGM-6-8	1	160
				12	DGM-6-12	1	187
				16	DGM-6-16	2	190
3.31	4	7	7.65/7.25	8	DGM-7-8	1	143
				12	DGM-7-12	1	152
				16	DGM-7-16	2	159
4.01	5	8	8.65/8.25	8	DGM-8-8	1	143
				12	DGM-8-12	1	152
				16	DGM-8-16	2	159
5.01	6	10	10.65/10.25	10	DGM-10-10	1	139
				16	DGM-10-16	2	148
				20	DGM-10-20	2	159
6.01	8	12	12.65/12.25	10	DGM-12-10	1	139
				16	DGM-12-16	2	148
				20	DGM-12-20	2	159
8.01	10	15	15.65/15.25	12	DGM-15-12	1	134
				20	DGM-15-20	2	143
				25	DGM-15-25	2	148
10.01	12	18	18.65/18.25	12	DGM-18-12	1	139
				20	DGM-18-20	2	152
				25	DGM-18-25	2	160
12.01	15	22	22.65/22.25	16	DGM-22-16	2	159
				28	DGM-22-28	2	161
				36	DGM-22-36	3	170
15.01	18	26	26.90/26.25	16	DGM-26-16	2	159
				28	DGM-26-28	2	161
				36	DGM-26-36	3	170

* Price on Application, prices subject to change.

Headless Liner Drill Bushings

L Type ANSI Headless Liner



VOLUME DISCOUNT

KEY FEATURES
/ Diameters from 5/16 to 2 1/4
/ Hardened to 60-65 HRC
/ OD lead for easy installation
/ ID radius improves SF location
/ OD ground to press fit size

APPLICATION
The 'L Type' liner bushing is permanently pressed into a drill jig or fixture plate. They provide a highly accurate location sleeve for the SF drill bushing whilst eradicating wear caused by drill bush replacement on the jig plate.

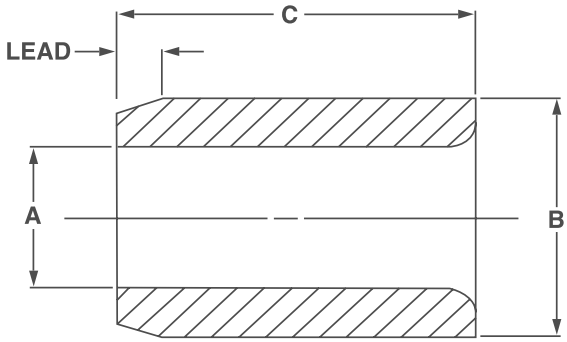
ORDERING INSTRUCTIONS
When Ordering State: Quantity and Symbol. Example: 6, L-32-22

NOTES
/ For general ordering information and technical data see pages 97-98
/ To order Oversize Bushings; suffix symbol with the letter U. Example: L-32-22U
/ Price list codes detailed below; please see price list.

Bore Size A		Outside Diameter B		C: Liner Length and Price Code Number											
				Prefix	1/4"	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"
3/16	0.1879 0.1876	5/16	0.3141 0.3138	L	-20-4 123	-20-5 126	-20-6 129	-20-8 130	-20-12 135						
5/16	0.3129 0.3126	1/2	0.5017 0.5014	L	-32-4 118	-32-5 119	-32-6 122	-32-8 123	-32-12 129	-32-16 137	-32-22 146				
1/2	0.5005 0.5002	3/4	0.7518 0.7515	L		-48-5 119	-48-6 123	-48-8 123	-48-12 126	-48-16 130	-48-22 145	-48-28 158	-48-34 174		
3/4	0.7506 0.7503	1	1.0018 1.0015	L				-64-8 135	-64-12 135	-64-16 139	-64-22 144	-64-28 161	-64-34 170	-64-40 191	-64-48 252
1	1.0007 1.0004	1-3/8	1.3772 1.3768	L				-88-8 170	-88-12 155	-88-16 170	-88-22 189	-88-28 201	-88-34 213	-88-40 225	-88-48 305
1-3/8	1.3760 1.3756	1-3/4	1.7523 1.7519	L					-112-12 196	-112-16 189	-112-22 196	-112-28 206	-112-34 222	-112-40 235	-112-48 329
1-3/4	1.7512 1.7508	2-1/4	2.2525 2.2521	L					-144-12 218	-144-16 207	-144-22 218	-144-28 227	-144-34 272	-144-40 299	-144-48 342
2-1/4	2.2515 2.2510	2-3/4	2.7526 2.7522	L					-176-12 228	-176-16 218	-176-22 229	-176-28 260	-176-34 294	-176-40 308	-176-48 344

Headless Liner Drill Bushings

LTW Type Thin Wall Liner



VOLUME DISCOUNT

KEY FEATURES
- Diameters from 5/16 to 2 1/4
- Hardened to 60-65 HRC
- OD lead for easy installation
- ID radius improves SF location
- OD ground to press fit size
- Thin wall space saving feature

APPLICATION
The 'LTW Type' liner bushing is permanently pressed into a drill jig or fixture plate. They provide a highly accurate location sleeve for the SF drill bushing whilst eradicating wear caused by drill bush replacement on the jig plate. The thin wall allows for greater space on the jig.

ORDERING INSTRUCTIONS
When Ordering State: Quantity and Symbol.
Example: 6, L-TW-40-4

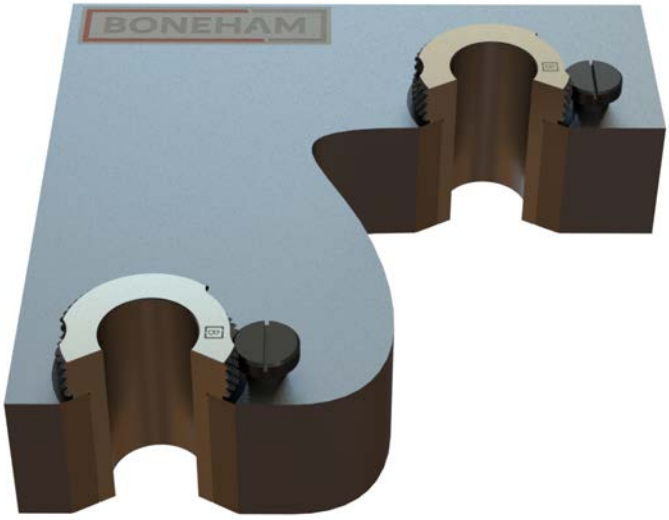
NOTES
- For general ordering information and technical data see pages 97-98
- To order Oversize Bushings; suffix symbol with the letter U. Example: L-TW-28-6U
- Price list codes detailed below; please see price list.

Bore Size A		Outside Diameter B		C: Liner Length and Price Code Number												
				Prefix	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
3/16	0.1879 0.1876	5/16	0.3141 0.3138	L-TW	-20-4 123	-20-5 126	-20-6 129	-20-8 130	-20-10 134	-20-12 135						
1/4	0.2504 0.2501	7/16	0.4392 0.4389	L-TW	-28-4 118	-28-5 119	-28-6 122	-28-8 123	-28-10 126	-28-12 129						
5/16	0.3129 0.3126	9/16	0.5642 0.5639	L-TW	-36-4 123	-36-5 118	-36-6 120	-36-8 120	-36-10 122	-36-12 123	-36-16 126					
3/8	0.3754 0.3751	5/8	0.6267 0.6264	L-TW	-40-4 123	-40-5 118	-40-6 120	-40-8 120	-40-10 122	-40-12 123	-40-16 126					
7/16	0.4380 0.4377	5/8	0.6267 0.6264	L-TW	-40-4X 123	-40-5X 118	-40-6X 120	-40-8X 120	-40-10X 122	-40-12X 123	-40-16X 126					
9/16	0.5630 0.5627	7/8	0.8768 0.8765	L-TW	-56-4 140	-56-5 138	-56-6 140	-56-8 134	-56-10 135	-56-12 135	-56-16 138					
5/8	0.6255 0.6252	7/8	0.8768 0.8765	L-TW		-56-5X 138	-56-6X 140	-56-8X 134	-56-10X 135	-56-12X 135	-56-16X 138	-56-20X 144				

Continued on next page

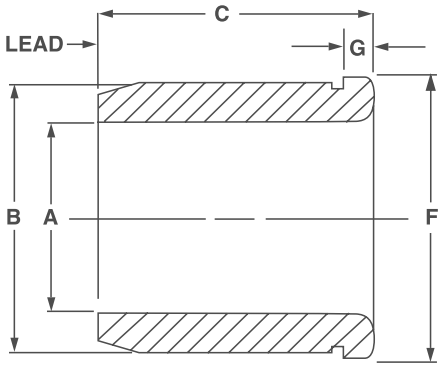
Headless Liner Drill Bushings

Bore Size A		Outside Diameter B		C: Liner Length and Price Code Number												
				Prefix	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"	1 1/4"	1 1/2"	1 3/4"	2"	2 1/4"
3/4	0.7506 0.7503	1	1.0018 1.0015	L-TW		-64-5 138	-64-6 140	-64-8 135	-64.10 135	-64-12 135	-64-16 139	-64-20 144				
7/8	0.8757 0.8754	1-1/4	1.2520 1.2517	L-TW			-80-6 169	-80-8 169	-80-10 164	-80-12 155	-80-16 169	-80-20 188	-80-24 192			
1	1.0007 1.0004	1-3/8	1.3772 1.3768	L-TW				-88-8 170	-88-10 167	-88-12 155	-88-16 170	-88-20 189	-88-24 193	-88-28 201		
1-1/8	1.1259 1.1255	1-1/2	1.5022 1.5018	L-TW				-96-8 190	-96-10 190	-96-12 196	-96-16 189	-96-20 196	-96-24 203	-96-28 206		
1-1/4	1.2509 1.2505	1-5/8	1.6272 1.6268	L-TW					-104-10 190	-104-12 195	-104-16 195	-104-20 195	-104-24 200	-104-28 206	-104-32 217	
1-3/8	1.3760 1.3756	1-3/4	1.7523 1.7519	L-TW					-112-10 196	-112-12 196	-112-16 189	-112-20 196	-112-24 200	-112-28 206	-112-32 222	
1-1/2	1.5010 1.5006	1-7/8	1.8773 1.8769	L-TW						-120-12 195	-120-16 195	-120-20 195	-120-24 200	-120-28 198	-120-32 218	-120-36 225



Headless Liner Drill Bushings

HL Type ANSI Liner Bushings



VOLUME DISCOUNT

KEY FEATURES
- Diameters from 5/16 to 2 1/4
- Hardened to 60-65 HRC
- OD lead for easy installation
- ID radius improves SF location
- OD ground to press fit size

APPLICATION
The 'HL Type' liner bushing is permanently pressed into a drill jig or fixture plate. They provide a highly accurate location sleeve for the SF drill bushing whilst eradicating wear caused by drill bush replacement on the jig plate. The head prevents the liner from slipping out the jig when excess axial force is placed on the workpiece.

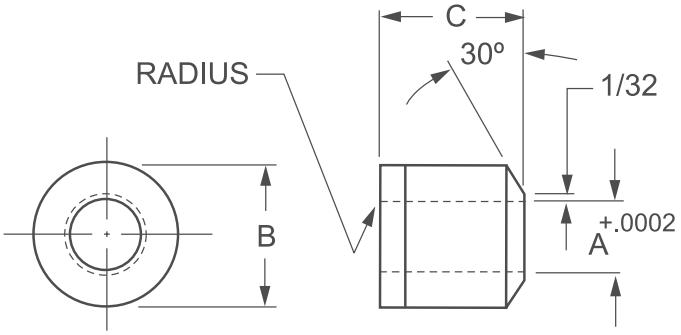
ORDERING INSTRUCTIONS
When Ordering State: Quantity and Symbol.
Example: 6, HL-32-22

NOTES
- For general ordering information and technical data see pages 97-98
- To order Oversize Bushings; suffix symbol with the letter U. Example: HL-32-22U
- Price list codes detailed below; please see price list.

Bore Size A		Outside Diameter B		C: Overall and Price Code Number											Head	
				Prefix	5/16"	3/8"	1/2"	3/4"	1"	1 3/8"	1 3/4"	2 1/8"	2 1/2"	3"	Dia. F	Thk. G
5/16	0.3129 0.3126	1/2	0.5017 0.5014	HL	-32-5 130	-32-6 135	-32-8 135	-32-12 140	-32-16 161	-32-22 189					5/8	3/32
1/2	0.5005 0.5002	3/4	0.7518 0.7515	HL	-48-5 134	-48-6 135	-48-8 135	-48-12 140	-48-16 152	-48-22 164	-48-28 187	-48-34 196			7/8	3/32
3/4	0.7506 0.7503	1	1.0018 1.0015	HL			-64-8 149	-64-12 153	-64-16 159	-64-22 164	-64-28 191	-64-34 201	-64-40 217	-64-48 314	1-1/8	1/8
1	1.0007 1.0004	1-3/8	1.3772 1.3768	HL			-88-8 180	-88-12 164	-88-16 180	-88-22 190	-88-28 201	-88-34 211	-88-40 225	-88-48 335	1-1/2	1/8
1-3/8	1.3760 1.3756	1-3/4	1.7523 1.7519	HL				-112-12 198	-112-16 203	-112-22 210	-112-28 222	-112-34 237	-112-40 291	-112-48 350	1-7/8	3/16
1-3/4	1.7512 1.7508	2-1/4	2.2525 2.2521	HL				-144-12 233	-144-16 224	-144-22 234	-144-28 276	-144-34 301	-144-40 320	-144-48 353	2-3/8	3/16
2-1/4	2.2515 2.2510	2-3/4	2.7526 2.7522	HL				-176-12 299	-176-16 268	-176-22 301	-176-28 316	-176-34 330	-176-40 338	-176-48 359	2-7/8	3/16

Gun Drill Bushings

GDI Type Gun Drill Inserts



VOLUME DISCOUNT

KEY FEATURES
- Diameters 5/64 to 3/4
- Heat treated to HRC 62-65
- ID / OD concentric within .0002 TIR
- ID tolerance - .0000 / + .0002

APPLICATION
Boneham's 'GDI Type' Gun Drill Bushing Inserts are intended for use with Gun Drill Liner bushings, designed to interchange depending on the drill and workpiece requirements, or after wear.

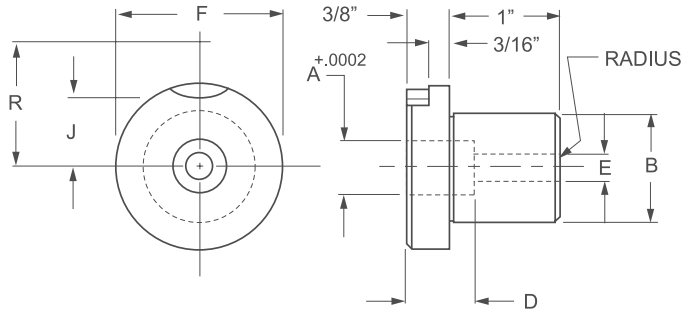
ORDERING INSTRUCTIONS
When ordering please state part number followed by required bore / ID size.
Example: GDI-13-8 .0890

NOTES
- Gun-Drill Bushings are classed as special bushings and require finish machining. GDI bushings are non-returnable.
- If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification.
- Boneham can manufacture the ¾ and 1" length bushings as well as nitrided or carbide for longer life.

Part No.	A	B	C
GDI-13-8	.0635-.0995 #52 - #39 1.65 - 2.50mm	13/64 0.2046 - 0.2043	1/2
GDI-16-8	.0980 - .1406 #40 - 9/64 2.50 - 3.50mm	1/4 0.2516 - 0.2513	1/2
GDI-20-8	.1250 - .1935 1/8 - #10 3.20 - 4.90mm	5/16 0.3141 - 0.3138	1/2
GDI-32-8	.1875 - .3160 3/16 - 0 4.8 - 8.00mm	1/2 0.5017 - 0.5014	1/2
GDI-48-8	.3125 - .5312 5/16 - 17/32 8.00 - 13.50mm	3/4 0.7518 - 0.7515	1/2
GDI-64-12	.5000 - .7656 1/2 - 49/64 13.00 - 19.00mm	1" 1.0018 - 1.0015	3/4

Gun Drill Bushings

GDL Type Gun Drill Liners



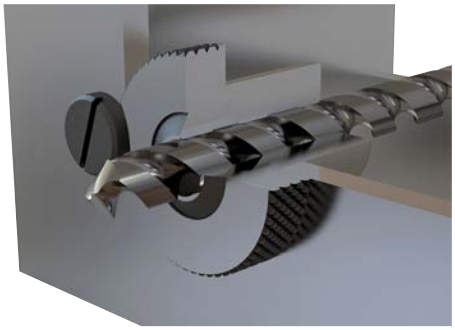
VOLUME DISCOUNT

KEY FEATURES
- Diameters 0.2045 to 1.0017
- Heat treated to HRC 62-65
- ID / OD concentric within .0002 TIR
- ID tolerance + .0002

APPLICATION
Boneham's 'GDL Type' Gun Drill Liners are high precision bushings for gun-drilling machines, and used in conjunction with removable Gun-Drill Inserts GDI, form a two piece system allowing more flexibility than the one piece bushing, with each liner able to hold a range of inserts.

ORDERING INSTRUCTIONS
When ordering please state part number followed by required bore / ID size.
Example: GDL-64-16 .0.5016

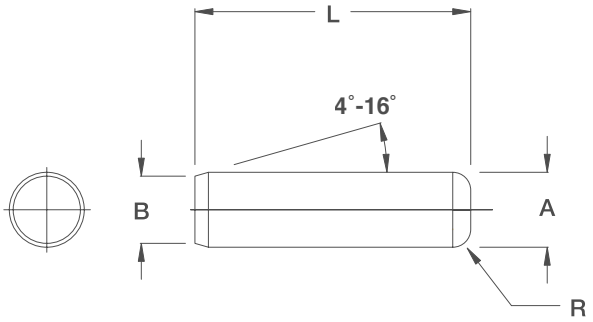
NOTES
- Gun-Drill Bushings are classed as special bushings and require finish machining. GDL bushings are non-returnable.
- If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification.



Part No.	A	B	D	E	F	J	R	Lock Screw	GDI Used
GDL-64-16	0.2045	1" 1.0000 - 0.9998	7/16	1/8	1-37/64	19/32	1-5/64	LS-2	GDI138
	0.2515			5/32					GDI168
	0.314			7/32					GDI208
	0.5016			11/32					GDI328
	0.7517			9/16					GDI488
GDL-88-16	0.2045	1-3/8 1.3750 - 1.3748	7/16	1/8	1-51/64	25/32	1-7/16	LS-2	GDI138
	0.2515			5/32					GDI168
	0.314			7/2					GDI208
	0.5016			11/32					GDI328
	0.7515			9/16					GDI488
	1.0017		11/16	51/64					GDI6412

Dowel Pins

INCH Dowel Pins to ASME 18.8.2-2000



VOLUME DISCOUNT

A= + .0001" / + .0003"

KEY FEATURES
- Precision ground alloy steel
- Diameters from 1/16 to 1"
- Surface hardness 60 HRC minimum
- Core hardness 50-58 HRC
- Chamfer and Radius
- Oversize to fit reamed hole

APPLICATION
ANSI standard parallel dowel pins are chamfered at the insertion end for easy location. Dowel pins are ground with accurate tolerances for exact alignment.

ORDERING INSTRUCTIONS
When ordering identify the nominal diameter required and then choose the length from the chart below. Example: 1/16 x 5/8

NOTES
If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification. Other available standards are listed on page 16.

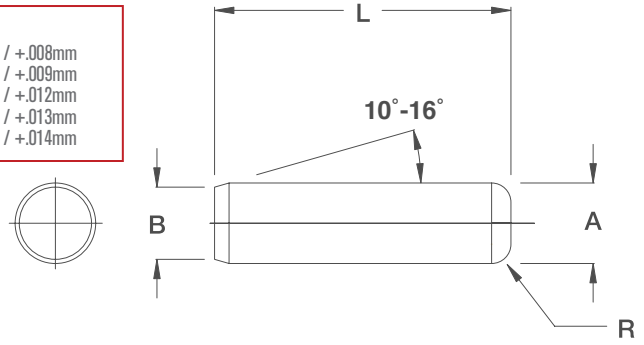
		Nominal Dia A												
		1/16"	3/32"	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"	5/8"	3/4"	7/8"	1"
	B	.058	.089	.120	.180	.240	.302	.365	.424	.486	.611	.735	.860	.980
		.048	.079	.110	.170	.230	.290	.350	.409	.471	.595	.715	.840	.960
	R min	.008	.012	.016	.023	.031	.039	.047	.055	.063	.078	.094	.109	.125
Length L	3/16"													
	1/4"													
	5/16"													
	3/8"													
	7/16"													
	1/2"													
	5/8"													
	3/4"													
	7/8"													
	1"													
	1 1/4"													
	1 1/2"													
	1 3/4"													
	2"													
	2 1/4"													
	2 1/2"													
	3"													
	3 1/2"													
	4"													
	4 1/2"													
	5"													
	5 1/2"													
	6"													

Dowel Pins

Metric Dowel Pins to ASME 18.8. 100m-2000

Limits on Diam A

1.5 to 3mm + .003 / +.008mm
4mm to 6mm + .004 / +.009mm
8mm to 10mm + .006 / +.012mm
12mm to 16mm + .007 / +.013mm
20mm to 25mm + .008 / +.014mm



VOLUME DISCOUNT

KEY FEATURES

/ Precision ground alloy steel
/ Diameters from 1.5mm to 25mm
/ Surface hardness 60 HRC minimum
/ Core hardness 50-58 HRC
/ Chamfer and Radius

APPLICATION

ANSI standard parallel dowel pins are chamfered at the insertion end for easy location. Dowel pins are ground with accurate tolerances for exact alignment.

ORDERING INSTRUCTIONS

When ordering identify the nominal diameter required and then choose the length from the chart below. Example: 4mm x 16mm

NOTES

If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification. Other available standards are listed on page 16.

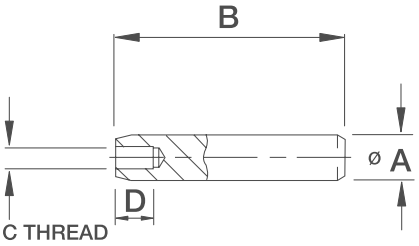
		Nominal Dia A												
		1.5	2	2.5	3	4	5	6	8	10	12	16	20	25
	B	1.4	1.9	2.4	2.9	3.9	4.9	5.8	7.8	9.8	11.8	15.8	19.8	24.8
		1.2	1.7	2.2	2.6	3.6	4.6	5.4	7.4	9.4	11.4	15.3	19.3	24.3
	R min	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.6	0.8	0.8	1mm
Length L	6													
	8													
	10													
	12													
	16													
	20													
	25													
	30													
	35													
	40													
	45													
	50													
	60													
	70													
	80													
	90													
	100													
	110													
	120													
	130													
	140													
	150													

Additional lengths can be supplied to order.

Pull Dowel Pins

INCH Pull Dowel Pins

Diam A= + .0001" / + .0003"
hardened 60-63 Rc



Supplied with or without air release flat.

VOLUME DISCOUNT

KEY FEATURES
/ Precision ground alloy steel
/ Diameters from 3/16 to 1"
/ Surface hardness 60-63 HRC
/ Core hardness 50-58 HRC
/ Chamfer and Radius

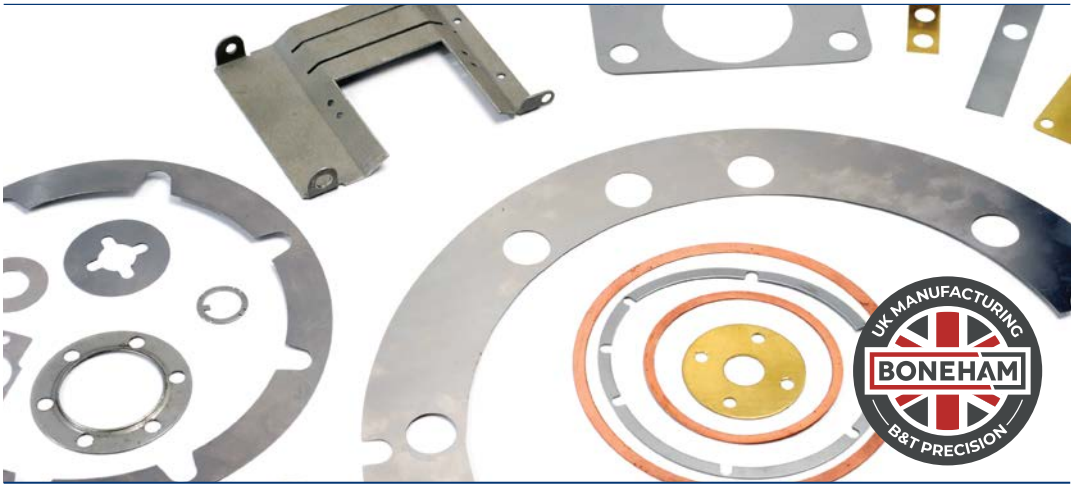
APPLICATION
Pull dowel pins are chamfered at both ends for easy location into the hole. Pull dowel pins are ground with accurate tolerances for exact alignment. The internal thread allows for extraction by a tool (see pages 61-62). They can be supplied with or without air release flats. Air release flats are ground on the dowel pin to allow for air displacement in blind holes.

ORDERING INSTRUCTIONS
When ordering identify the nominal diameter required and then choose the length from the chart below. Example: 1/4" x 1"

NOTES
If you cannot find what you are looking for, Boneham can manufacture special sizes and materials to specification. Other available standards are listed on page 16.

Diam A	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
1/2"								
5/8"								
3/4"								
1"								
1 1/4"								
1 1/2"								
1 3/4"								
2"								
2 1/4"								
2 1/2"								
3"								
C Thread	4-40	8-32	10-32	10-32	1/4-20	5/16-18	5/16-18	5/16-18
D	1/4"	1/4"	1/4"	3/8"	1/2"	1/2"	1/2"	1/2"

Shims to Order



Shims are commonly used for aligning or spacing between two components or surfaces to allow for wear compensation or tolerance accumulation (dimensional variance). The process of placing and removing pieces of shim for alignment acquired the name “shimming”. Similarly shims are used for bearing adjustment. Shims can be manufactured from various materials and take many profiles.

Laminated shims provide peelable layers allowing for variable thicknesses to reduce working time, and the necessity to stock a large variety of shim thicknesses. Laminated shims can also be used to remove the wear out of rotating shafts and adjusting the tolerances on the top and bottom of the alignment.

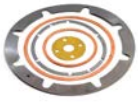
The differing applications for shims are listed below and further information can be acquired from www.boneham.co.uk

Most commonly used in Construction, Aerospace. Automotive and Agriculture Engineering, and composites.

/ Brass

/ Stainless Steel

/ Laminated Steel
/ Laminated Brass
/ Laminated Aluminium
/ Aluminium



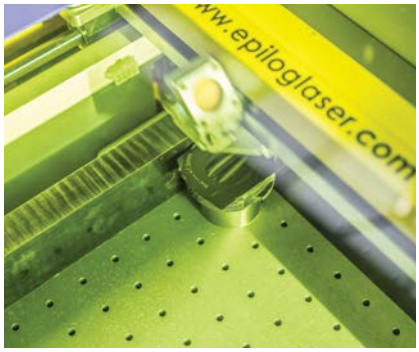
/ Copper

/ Steel (CS4 CR4)

- / Rectangular, circular or special shapes
- / Steel, brass, stainless, copper and laminated
- / Thickness range .001” (0.025mm) to .125” (3.125mm) dependent on material
- / Rapid quotation and manufacturing service
- / Competitive Prices
- / Quality Assured
- / Quality Materials
- / Large Tooling Range Available
- / Deliveries to suit your requirements

Various Applications

- / Pumps
- / Clutches
- / Actuators
- / Brakes
- / Valves
- / Compressors
- / Power Transmissions
- / Gear Boxes



Part Marking

We would be pleased to quote for your requirements / Tel: +44 (0) 1623 445 450 / Fax: +44 (0) 1623 445 451

Pre-packed Shim Stock

C110 Annealed Copper

HUGE STOCKS

VOLUME DISCOUNT

FEATURES
/ Annealed
/ 99.9% Copper
/ Rockwell 15T47-57
/ 6" Widths

APPLICATIONS
C110 Copper has high electrical and heat conductivity. Copper is extremely malleable with good cold working properties. Due to its outstanding heat conductivity and malleability, Copper is ideal for gaskets, washer's, heat exchanger components and shims. Copper's attributes also make it an ideal choice for electrical components.

ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

6" x 50" C110 Copper Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHCUX-1	0.001	0.025mm	6"	50"	0.045
SHCUX-2	0.002	0.051mm	6"	50"	0.086
SHCUX-3	0.003	0.076mm	6"	50"	0.132
SHCUX-4	0.004	0.102mm	6"	50"	0.168
SHCUX-5	0.005	0.127mm	6"	50"	0.209
SHCUX-6	0.006	0.152mm	6"	50"	0.254
SHCUX-7	0.007	0.178mm	6"	50"	0.295
SHCUX-8	0.008	0.203mm	6"	50"	0.336
SHCUX-10	0.010	0.254mm	6"	50"	0.422
SHCUX-15	0.015	0.381mm	6"	50"	0.630
SHCUX-20	0.020	0.508mm	6"	50"	0.830
SHCUX-25	0.025	0.635mm	6"	50"	1.048
SHCUX-32	0.032	0.813mm	6"	50"	1.343

Continued on next page

6” x 100” C110 Copper Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHCU-1	0.001	0.025mm	6"	100"	0.086
SHCU-2	0.002	0.051mm	6"	100"	0.172
SHCU-3	0.003	0.076mm	6"	100"	0.259
SHCU-4	0.004	0.102mm	6"	100"	0.336
SHCU-5	0.005	0.127mm	6"	100"	0.417
SHCU-6	0.006	0.152mm	6"	100"	0.503
SHCU-7	0.007	0.178mm	6"	100"	0.585
SHCU-8	0.008	0.203mm	6"	100"	0.671
SHCU-10	0.010	0.254mm	6"	100"	0.839
SHCU-15	0.015	0.381mm	6"	100"	1.256
SHCU-20	0.020	0.508mm	6"	100"	1.660
SHCU-25	0.025	0.635mm	6"	100"	2.096
SHCU-32	0.032	0.813mm	6"	100"	2.681

Pre-packed Shim Stock

260 Half Hard Brass

HUGE STOCKS

VOLUME DISCOUNT

FEATURES
/ Half Hard
/ Rockwell 30T56 - 68
/ 6" and 12" Widths

APPLICATIONS
260 (C26000) Brass has the highest formability of all yellow brasses. 260 Brass has high electrical and heat conductivity, as well as, significant corrosion resistance. These attributes make 260 Brass ideal for electronic, heating and plumbing components, shims, washers and fasteners. Brass is an attractive alloy, and as such, is perfect for decorative applications.

ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

6" x 100" 260 Brass Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHBRS-1	0.001	0.025	6"	100"	0.086
SHBRS-1X	0.0015	0.038	6"	100"	0.127
SHBRS-2	0.002	0.051	6"	100"	0.168
SHBRS-3	0.003	0.076	6"	100"	0.249
SHBRS-4	0.004	0.102	6"	100"	0.336
SHBRS-5	0.005	0.127	6"	100"	0.422
SHBRS-6	0.006	0.152	6"	100"	0.503
SHBRS-7	0.007	0.178	6"	100"	0.590
SHBRS-8	0.008	0.203	6"	100"	0.671
SHBRS-9	0.009	0.229	6"	100"	0.753
SHBRS-10	0.010	0.254	6"	100"	0.839
SHBRS-12	0.012	0.305	6"	100"	1.007
SHBRS-15	0.015	0.381	6"	100"	1.256
SHBRS-20	0.020	0.508	6"	100"	1.678
SHBRS-25	0.025	0.635	6"	100"	2.096
SHBRS-31	0.031	0.787	6"	100"	2.599

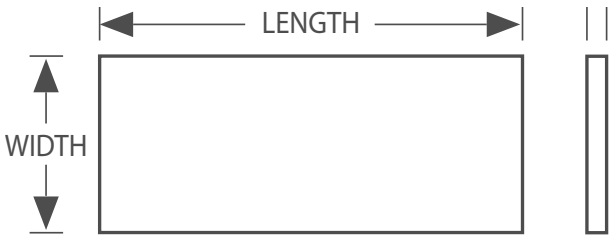
Continued on next page

12” x 120” 260 Brass Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHBRW-1	0.001	0.025	12"	120"	0.204
SHBRW-2	0.002	0.051	12"	120"	0.404
SHBRW-3	0.003	0.076	12"	120"	0.603
SHBRW-4	0.004	0.102	12"	120"	0.807
SHBRW-5	0.005	0.127	12"	120"	1.007
SHBRW-6	0.006	0.152	12"	120"	1.207
SHBRW-8	0.008	0.203	12"	120"	1.610
SHBRW-10	0.010	0.254	12"	120"	2.014
SHBRW-12	0.012	0.305	12"	120"	2.413
SHBRW-15	0.015	0.381	12"	120"	3.016
SHBRW-20	0.020	0.508	12"	120"	4.023
SHBRW-25	0.025	0.635	12"	120"	5.030
SHBRW-31	0.031	0.787	12"	120"	6.237

Pre-packed Shim Stock

302 Hardened Stainless Steel



HUGE STOCKS

STAINLESS STEEL

VOLUME DISCOUNT

FEATURES
/ Hardened
/ Rockwell C 40 - 45
/ 6" and 12" Widths

APPLICATIONS
302 Hardened Stainless Steel is resistive to corrosion, strong and durable. 302 Stainless is commonly used to make washers, gaskets, shim, brackets, springs and screens. 302 Stainless is easy to clean and is an attractive material which lends it to being used in decorative applications.

ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

6" x 50" 302 Hardened Stainless Steel Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHSS-X	0.0005	0.013	6"	50"	0.018
SHSS-1	0.001	0.025	6"	50"	0.041
SHSS-1X	0.0015	0.038	6"	50"	0.064
SHSS-2	0.002	0.051	6"	50"	0.082
SHSS-3	0.003	0.076	6"	50"	0.118
SHSS-4	0.004	0.102	6"	50"	0.159
SHSS-5	0.005	0.127	6"	50"	0.200
SHSS-6	0.006	0.152	6"	50"	0.240
SHSS-7	0.007	0.178	6"	50"	0.281
SHSS-8	0.008	0.203	6"	50"	0.318
SHSS-9	0.009	0.229	6"	50"	0.358
SHSS-10	0.010	0.254	6"	50"	0.399
SHSS-12	0.012	0.305	6"	50"	0.476
SHSS-15	0.015	0.381	6"	50"	0.599
SHSS-20	0.020	0.508	6"	50"	0.798
SHSS-25	0.025	0.635	6"	50"	0.993
SHSS-31	0.031	0.787	6"	50"	1.234

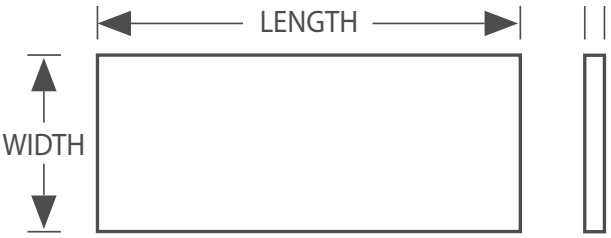
Continued on next page

12” x 100” 302 Hardened Stainless Steel Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHSSHW-X	0.0005	0.013	12"	100"	0.082
SHSSHW-1	0.001	0.025	12"	100"	0.163
SHSSHW-1X	0.0015	0.038	12"	100"	0.254
SHSSHW-2	0.002	0.051	12"	100"	0.327
SHSSHW-3	0.003	0.076	12"	100"	0.472
SHSSHW-4	0.004	0.102	12"	100"	0.635
SHSSHW-5	0.005	0.127	12"	100"	0.798
SHSSHW-6	0.006	0.152	12"	100"	0.962
SHSSHW-7	0.007	0.178	12"	100"	1.125
SHSSHW-8	0.008	0.203	12"	100"	1.270
SHSSHW-10	0.010	0.254	12"	100"	1.597
SHSSHW-12	0.012	0.305	12"	100"	1.905
SHSSHW-15	0.015	0.381	12"	100"	2.395
SHSSHW-20	0.020	0.508	12"	100"	3.193
SHSSHW-25	0.025	0.635	12"	100"	3.974
SHSSHW-31	0.031	0.787	12"	100"	4.935

Pre-packed Shim Stock

316 Annealed Stainless Steel



FEATURES
/ Annealed
/ Rockwell B95 max
/ 6" and 12" Widths

APPLICATIONS
316 Stainless Steel has a high corrosion and pitting resistance. Due to its high corrosion resistance and formability, 316 is common for shim manufacture, washers, gaskets, medical, food and marine applications.

ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

6" x 50" Rolled Shim Stock 316 Stainless

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SH316SS-1	0.001	0.025	6"	50"	0.041
SH316SS-2	0.002	0.051	6"	50"	0.082
SH316SS-3	0.003	0.076	6"	50"	0.118
SH316SS-4	0.004	0.102	6"	50"	0.159
SH316SS-5	0.005	0.127	6"	50"	0.200
SH316SS-6	0.006	0.152	6"	50"	0.240
SH316SS-7	0.007	0.178	6"	50"	0.281
SH316SS-8	0.008	0.203	6"	50"	0.318
SH316SS-10	0.010	0.254	6"	50"	0.399
SH316SS-12	0.012	0.305	6"	50"	0.476
SH316SS-15	0.015	0.381	6"	50"	0.599
SH316SS-20	0.020	0.508	6"	50"	0.798
SH316SS-25	0.025	0.635	6"	50"	0.993
SH316SS-31	0.031	0.787	6"	50"	1.234

Continued on next page

12” x 100” Rolled Shim Stock 316 Stainless

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SH316SSHW-1	0.001	0.025	12"	100"	0.163
SH316SSHW-2	0.002	0.051	12"	100"	0.327
SH316SSHW-3	0.003	0.076	12"	100"	0.472
SH316SSHW-4	0.004	0.102	12"	100"	0.635
SH316SSHW-5	0.005	0.127	12"	100"	0.798
SH316SSHW-6	0.006	0.152	12"	100"	0.962
SH316SSHW-7	0.007	0.178	12"	100"	1.125
SH316SSHW-8	0.008	0.203	12"	100"	1.270
SH316SSHW-10	0.010	0.254	12"	100"	1.597
SH316SSHW-12	0.012	0.305	12"	100"	1.905
SH316SSHW-15	0.015	0.381	12"	100"	2.395
SH316SSHW-20	0.020	0.508	12"	100"	3.193
SH316SSHW-25	0.025	0.635	12"	100"	3.974
SH316SSHW-31	0.031	0.787	12"	100"	4.935

Pre-packed Shim Stock

510 Phosphor Bronze Spring Tempered

HUGE STOCKS

VOLUME DISCOUNT

FEATURES:
/ Spring Tempered
/ Grade A
/ Rockwell 30T76 - 80
/ 6" Widths

APPLICATIONS
510 Spring Tempered Phosphor Bronze is hard and has a high resistance to fatigue and corrosion. 510 Phosphor Bronze has high formability with the added benefit of welding, brazing and soldering capabilities. Phosphor bronze has excellent cold working and electrical properties. Ideal applications are electrical components, washers, gaskets, shims, fasteners, springs and bearings.

ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

6" x 50" 510 Phosphor Bronze Spring Tempered

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHPBX-5	0.005	0.127	6"	50"	0.195
SHPBX-8	0.008	0.203	6"	50"	0.313
SHPBX-10	0.010	0.254	6"	50"	0.390
SHPBX-13	0.013	0.330	6"	50"	0.508
SHPBX-16	0.016	0.406	6"	50"	0.621
SHPBX-20	0.020	0.508	6"	50"	0.780
SHPBX-25	0.025	0.635	6"	50"	0.971
SHPBX-32	0.032	0.813	6"	50"	1.243
SHPBX-40	0.040	1.016	6"	50"	1.556
SHPBX-50	0.050	1.270	6"	50"	1.941
SHPBX-64	0.064	1.626	6"	50"	2.486

Continued on next page

6” x 96” 510 Phosphor Bronze Spring Tempered

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHPB-5	0.005	0.127	6''	96''	0.417
SHPB-8	0.008	0.203	6''	96''	0.671
SHPB-10	0.010	0.254	6''	96''	0.839
SHPB-13	0.013	0.330	6''	96''	1.089
SHPB-16	0.016	0.406	6''	96''	1.338
SHPB-20	0.020	0.508	6''	96''	1.674
SHPB-25	0.025	0.635	6''	96''	2.087
SHPB-32	0.032	0.813	6''	96''	2.676
SHPB-40	0.040	1.016	6''	96''	3.348
SHPB-50	0.050	1.270	6''	96''	4.182
SHPB-64	0.064	1.626	6''	96''	5.357

Pre-packed Shim Stock

AISI 1010 Cold Rolled Steel (CS4 / CR4)

HUGE STOCKS

VOLUME DISCOUNT

FEATURES
/ Hardened and Tempered
/ Rockwell B 90 min
/ 6" and 12" Widths

APPLICATIONS
1010 Cold Rolled Steel has good formability and machinability, it is also magnetic. Ideal for the manufacture of shims, washers, gaskets, fasteners, plates and brackets.

ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

6" x 100" 1100 Cold Rolled Steel Shim Pack

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHCRS-1	0.001	0.025	6"	100"	0.113
SHCRS-1X	0.0015	0.038	6"	100"	0.118
SHCRS-2	0.002	0.051	6"	100"	0.191
SHCRS-3	0.003	0.076	6"	100"	0.263
SHCRS-4	0.004	0.102	6"	100"	0.327
SHCRS-5	0.005	0.127	6"	100"	0.435
SHCRS-6	0.006	0.152	6"	100"	0.517
SHCRS-7	0.007	0.178	6"	100"	0.594
SHCRS-8	0.008	0.203	6"	100"	0.689
SHCRS-9	0.009	0.229	6"	100"	0.753
SHCRS-10	0.010	0.254	6"	100"	0.830
SHCRS-12	0.012	0.305	6"	100"	1.016
SHCRS-15	0.015	0.381	6"	100"	1.252
SHCRS-20	0.020	0.508	6"	100"	1.746
SHCRS-25	0.025	0.635	6"	100"	2.286
SHCRS-31	0.031	0.787	6"	100"	2.985

Continued on next page

12” x 120” 1100 Cold Rolled Steel Shim Pack

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHCRW-1	0.001	0.025	12"	120"	0.848
SHCRW-2	0.002	0.051	12"	120"	0.494
SHCRW-3	0.003	0.076	12"	120"	0.671
SHCRW-4	0.004	0.102	12"	120"	0.862
SHCRW-5	0.005	0.127	12"	120"	1.034
SHCRW-6	0.006	0.152	12"	120"	1.234
SHCRW-7	0.007	0.178	12"	120"	1.383
SHCRW-8	0.008	0.203	12"	120"	1.647
SHCRW-9	0.009	0.229	12"	120"	1.882
SHCRW-10	0.010	0.254	12"	120"	2.105
SHCRW-12	0.012	0.305	12"	120"	2.427
SHCRW-15	0.015	0.381	12"	120"	3.035
SHCRW-20	0.020	0.508	12"	120"	4.209
SHCRW-25	0.025	0.635	12"	120"	5.103
SHCRW-31	0.031	0.787	12"	120"	6.160

Pre-packed Shim Stock

C1095 Blue Tempered Spring Steel

HUGE STOCKS

VOLUME DISCOUNT

FEATURES
/ Tempered
/ Polished
/ Rockwell C 48 - 51
/ 3" and 6" Widths

ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

APPLICATIONS
1095 Blue Tempered Spring Steel combines high tensile strength with maximum fatigue life. Ideal for tool and die applications due to its toughness. Typically shims, washers and plates, but primarily springs are made from C1095.

3" x 50" C1095 Blue Tempered Rolled Shim Stock

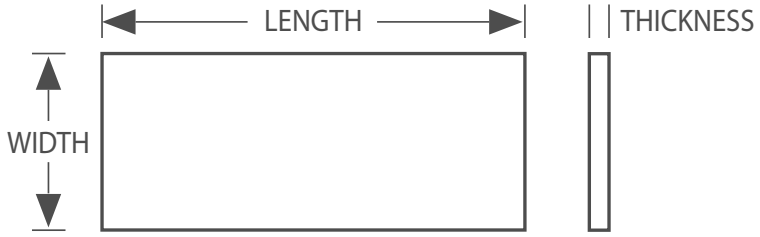
Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHBTS-2	0.002	0.051	3"	50"	0.041
SHBTS-3	0.003	0.076	3"	50"	0.059

6" x 50" C1095 Blue Tempered Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHBTS-4	0.004	0.102	6"	50"	0.154
SHBTS-5	0.005	0.127	6"	50"	0.195
SHBTS-6	0.006	0.152	6"	50"	0.236
SHBTS-7	0.007	0.178	6"	50"	0.272
SHBTS-8	0.008	0.203	6"	50"	0.313
SHBTS-10	0.010	0.254	6"	50"	0.404
SHBTS-12	0.012	0.305	6"	50"	0.426
SHBTS-15	0.015	0.381	6"	50"	0.585
SHBTS-16	0.016	0.406	6"	50"	0.621
SHBTS-18	0.018	0.457	6"	50"	0.699
SHBTS-20	0.020	0.508	6"	50"	0.780
SHBTS-25	0.025	0.635	6"	50"	0.971
SHBTS-28	0.028	0.711	6"	50"	1.089
SHBTS-30	0.030	0.762	6"	50"	1.166
SHBTS-32	0.032	0.813	6"	50"	1.243

Pre-packed Shim Stock

1100 Aluminium Tempered



HUGE STOCKS

VOLUME DISCOUNT

FEATURES
/ Tempered
/ Temper H-18/19
/ 6" Widths

APPLICATIONS
1100 Aluminium is highly malleable, incredibly light and strong. Aluminium has excellent cold working properties, high electrical and heat conductivity and resistance to corrosion. These properties make 1100 Aluminium ideal for automotive, aerospace and food processing components. Components such as washers, shims, gaskets and electrical pieces.

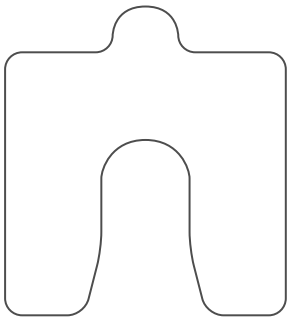
ORDERING INSTRUCTIONS
Identify thickness, width and length required from the tables below or identify part number. Other sizes can be cut to custom size.

6" x 100" 1100 Aluminium Rolled Shim Stock

Part Reference	Thickness		Width (inch)	Length (Inch)	Kg
	Inch	Metric			
SHAL-1	0.001	0.025	6"	100"	0.027
SHAL-2	0.002	0.051	6"	100"	0.054
SHAL-3	0.003	0.076	6"	100"	0.082
SHAL-4	0.004	0.102	6"	100"	0.109
SHAL-5	0.005	0.127	6"	100"	0.132
SHAL-6	0.006	0.152	6"	100"	0.159
SHAL-8	0.008	0.203	6"	100"	0.213
SHAL-10	0.010	0.254	6"	100"	0.272
SHAL-15	0.015	0.381	6"	100"	0.408
SHAL-20	0.020	0.508	6"	100"	0.544
SHAL-25	0.025	0.635	6"	100"	0.662
SHAL-32	0.032	0.813	6"	100"	0.862

Slotted Alignment Shims

Stainless Steel Slotted Shim Packs



HUGE STOCKS
STAINLESS STEEL
VOLUME DISCOUNT

FEATURES
/ No Sharp Edges
/ 300 Series Stainless Steel
/ Universal Slot Widths
/ Etched Thicknesses on each Shim

APPLICATIONS
Alignment shims are used to correct alignment in many applications, such as machinery, motors and shafts. They can be easily added and removed due to the tab feature and rounded edges. Each thicknesses is easily identifiable on the shim.

ORDERING INSTRUCTIONS
Identify the kit required by either the slot width or the dimensions of the alignment shim, and quote the corresponding part number. For replacement kits, identify the dimensions of your kit and choose the replacement thicknesses and quote the corresponding part number.

Alignment Shim Packs 20 pcs

Part Reference	Dimensions	Thicknesses (20 Pcs)	Slot Size	Kg
SHSSFK-A	2" x 2"	.001, .002, .003, .004, .005, .010, .015, .020, .025, .050, .075, .100, .125	5/8"	5.307
SHSSFK-B	3" x 3"	.001, .002, .003, .004, .005, .010, .015, .020, .025, .050, .075, .100, .125	3/4"	11.657
SHSSFK-C	4" x 4"	.001, .002, .003, .004, .005, .010, .015, .020, .025, .050, .075, .100, .125	1-1/4"	19.595
SHSSFK-D	5" x 5"	.001, .002, .003, .004, .005, .010, .015, .020, .025, .050, .075, .100, .125	1-5/8"	28.350

Replacement Shims 20 pcs

A

Part Reference	Dimensions	Thicknesses (20 Pcs)	Slot Size	Kg
SHRPSS-A-001	2" x 2"	0.001	5/8"	0.014
SHRPSS-A-002	2" x 2"	0.002	5/8"	0.023
SHRPSS-A-003	2" x 2"	0.003	5/8"	0.032
SHRPSS-A-004	2" x 2"	0.004	5/8"	0.041
SHRPSS-A-005	2" x 2"	0.005	5/8"	0.050
SHRPSS-A-010	2" x 2"	0.010	5/8"	0.095
SHRPSS-A-015	2" x 2"	0.015	5/8"	0.145
SHRPSS-A-020	2" x 2"	0.020	5/8"	0.200
SHRPSS-A-025	2" x 2"	0.025	5/8"	0.245
SHRPSS-A-050	2" x 2"	0.050	5/8"	0.490
SHRPSS-A-075	2" x 2"	0.075	5/8"	0.708
SHRPSS-A-100	2" x 2"	0.100	5/8"	0.925
SHRPSS-A-125	2" x 2"	0.125	5/8"	1.143

Continued on next page

Replacement Shims 20 pcs

B

Part Reference	Dimensions	Thicknesses (20 Pcs)	Slot Size	Kg
SHRPSS-B-001	3" x 3"	0.001	3/4"	0.032
SHRPSS-B-002	3" x 3"	0.002	3/4"	0.054
SHRPSS-B-003	3" x 3"	0.003	3/4"	0.068
SHRPSS-B-004	3" x 3"	0.004	3/4"	0.095
SHRPSS-B-005	3" x 3"	0.005	3/4"	0.113
SHRPSS-B-010	3" x 3"	0.010	3/4"	0.218
SHRPSS-B-015	3" x 3"	0.015	3/4"	0.345
SHRPSS-B-020	3" x 3"	0.020	3/4"	0.445
SHRPSS-B-025	3" x 3"	0.025	3/4"	0.553
SHRPSS-B-050	3" x 3"	0.050	3/4"	1.107
SHRPSS-B-075	3" x 3"	0.075	3/4"	1.633
SHRPSS-B-100	3" x 3"	0.100	3/4"	2.214
SHRPSS-B-125	3" x 3"	0.125	3/4"	2.631

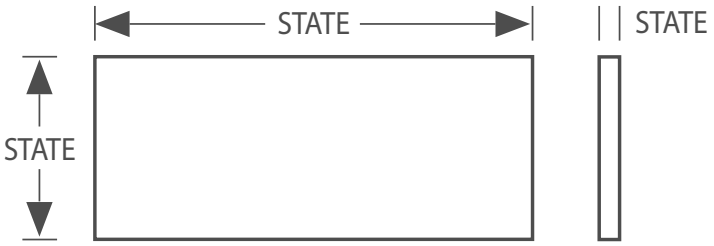
C

Part Reference	Dimensions	Thicknesses (20 Pcs)	Slot Size	Kg
SHRPSS-C-001	4" x 4"	0.001	1-1/4"	0.050
SHRPSS-C-002	4" x 4"	0.002	1-1/4"	0.086
SHRPSS-C-003	4" x 4"	0.003	1-1/4"	0.122
SHRPSS-C-004	4" x 4"	0.004	1-1/4"	0.159
SHRPSS-C-005	4" x 4"	0.005	1-1/4"	0.195
SHRPSS-C-010	4" x 4"	0.010	1-1/4"	0.367
SHRPSS-C-015	4" x 4"	0.015	1-1/4"	0.590
SHRPSS-C-020	4" x 4"	0.020	1-1/4"	0.771
SHRPSS-C-025	4" x 4"	0.025	1-1/4"	0.953
SHRPSS-C-050	4" x 4"	0.050	1-1/4"	1.869
SHRPSS-C-075	4" x 4"	0.075	1-1/4"	2.776
SHRPSS-C-100	4" x 4"	0.100	1-1/4"	3.756
SHRPSS-C-125	4" x 4"	0.125	1-1/4"	4.500

D

Part Reference	Dimensions	Thicknesses (20 Pcs)	Slot Size	Kg
SHRPSS-D-001	5" x 5"	0.001	1-5/8"	0.077
SHRPSS-D-002	5" x 5"	0.002	1-5/8"	0.136
SHRPSS-D-003	5" x 5"	0.003	1-5/8"	0.195
SHRPSS-D-004	5" x 5"	0.004	1-5/8"	0.245
SHRPSS-D-005	5" x 5"	0.005	1-5/8"	0.295
SHRPSS-D-010	5" x 5"	0.010	1-5/8"	0.581
SHRPSS-D-015	5" x 5"	0.015	1-5/8"	0.898
SHRPSS-D-020	5" x 5"	0.020	1-5/8"	1.179
SHRPSS-D-025	5" x 5"	0.025	1-5/8"	1.461
SHRPSS-D-050	5" x 5"	0.050	1-5/8"	3.012
SHRPSS-D-075	5" x 5"	0.075	1-5/8"	4.282
SHRPSS-D-100	5" x 5"	0.100	1-5/8"	5.697
SHRPSS-D-125	5" x 5"	0.125	1-5/8"	6.931

Shim Material – Cut to Size



HUGE STOCKS

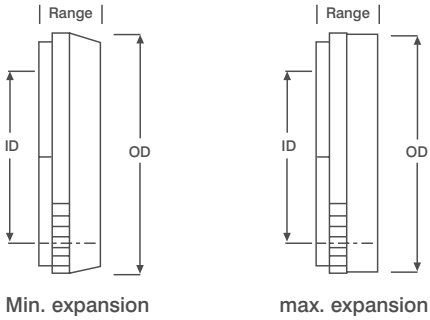
STAINLESS STEEL

- All thicknesses to standard gauge sizes.
- Other materials available to order – Aluminium, Phosphor Bronze.
- Also Laminated Steel, Brass, Aluminium, Stainless Steel.
- Parallel flat services for use with other clamps or by itself.

Bronze
Steel CS4 / CR4
Stainless 302 / 304 / 316
Brass
Laminate
Copper

Steel CS4/CR4			Brass CZ108			Stainless 302		
Thickness		Width	Thickness		Width	Thickness		Width
.001	(.025mm)	12"	.002	(.05mm)	8"	.001	(.025mm)	12"
.0015	(.038mm)	12"	.003	(.076mm)	12"	.002	(.05mm)	12"
.002	(.05mm)	24"	.004	(.1mm)	6"	.003	(.076mm)	12"
.003	(.076mm)	24"	.005	(.127mm)	12"	.004	(.1mm)	12"
.004	(.1mm)	24"	.010	(.25mm)	12"	.005	(.127mm)	12"
.005	(.127mm)	24"	.015	(.38mm)	12"	.006	(.152mm)	12"
.006	(.152mm)	24"	.020	(.5mm)	12"	.008	(.2mm)	12"
.007	(.177mm)	24"				.010	(.25mm)	12"
.008	(.2mm)	24"				.015	(.38mm)	6"
.010	(.25mm)	24"				.020	(.5mm)	12"
.012	(.30mm)	12"				.025	(.635mm)	12"
.015	(.38mm)	24"				.030	(.76mm)	TO ORDER
.020	(.5mm)	24"				.040	(1mm)	TO ORDER
.025	(.635mm)	12"						
.030	(.76mm)	TO ORDER						
.030	(.91mm)	TO ORDER						
.040	(1mm)	TO ORDER						
.050	(1.27mm)	TO ORDER						
.060	(1.5mm)	TO ORDER						
.080	(2.03mm)	TO ORDER						
.100	(2.54mm)	TO ORDER						
.118	(3mm)	TO ORDER						
.125	(3.17mm)	TO ORDER						

Euco Milling Arbor Micrometer Spacers



- The material used is an alloy steel specially selected for wear resistance and durability, satin chrome plated, faces lapped.
- All spacers have a thread pitch of 1mm.The engraved scale on imperial spacers is provided with 40 divisions,every fourth division is numbered (0-9) each graduation is .001" and adjustment is accurate to approximately .0005". Any closer adjustment is easily made after a trial cut.
- Metric spacers have 50 divisions ,every fifth division is numbered (0-9) each graduation is .02mm and adjustment is accurate to approximately 0.1mm

IMPERIAL

Ref.	Bore	OD	Key Way Width	Key Way Depth	Flange Dia.	Thread Dia.	Minimum Width	Expansion
MSS0	3/4	1.48	1/8	5/64	1.22	1.04	.250	.040
MSS0A	3/4	1.48	1/8	5/64	1.22	1.04	.438	.080
MSS1	1	1.88	1/4	3/32	1.50	1.44	.250	.040
MSS1A	1	1.88	1/4	3/32	1.50	1.44	.438	.080
MSS2	1.1/4	2.22	5/16	1/8	1.88	1.72	.250	.040
MSS2A	1.1/4	2.22	5/16	1/8	1.88	1.72	.438	.080
MSS3	1.1/2	2.56	3/8	5/32	2.19	2.10	.250	.040
MSS3A	1.1/2	2.56	3/8	5/32	2.19	2.10	.438	.080
MSS4B	2	3.31	1/2	3/16	2.81	2.68	.438	.080
MSS5	2.1/2	3.98	5/8	7/32	3.50	3.25	.438	.080

METRIC

Ref.	Bore	OD	Key Way Width	Key Way Depth	Flange Dia.	Thread Dia.	Minimum Width	Expansion
MSM5	16	34.30	4	2	27	23.30	6.30	1
MSM5A	16	34.30	4	2	27	23.30	11	2
MSM7	22	43.20	6	2.61	35	31.75	6.30	1
MSM7A	22	43.20	6	2.61	35	31.75	11.00	2
MSM1	27	50.20	7	3.25	43	38.90	6.30	1
MSM1A	27	50.20	7	3.25	43	38.90	11.00	2
MSM12	32	56.20	8	3.25	48	43.66	6.30	1
MSM12A	32	56.20	8	3.25	48	43.66	11.00	2
MSM12D	32	54.00					17.50	5
MSM15	40	67.10	10	4	58	55.70	6.30	1
MSM15A	40	67.10	10	4	58	55.70	11.00	2
MSM15D	40	62.00					17.50	5
MSM20A	50	83.60	12	4	71	68.26	11.00	2
MSM25A	60	100.80	14	4.50	89	81.15	11.00	2

The World's Leading Sealing & Flow Control Technology

With over 3 billion parts installed and failure rates less than 1 part per million, SFC KOENIG® is recognised around the world for reliable, safe and effective sealing and flow control. With our unique expanding seal technology our parts reduce contamination, withstand high pressures and provide leak-free performance for long life cycles.

SFC KOENIG is the original inventor of the one piece, metal-to-metal sealing solution, the KOENIG EXPANDER®, and all SFC KOENIG components are recognised for best-in-class performance in even the most critical applications.

With a combined 180 years of experience, BONEHAM and SFC KOENIG are ready to deliver a solution designed for your application and can integrate our products into your production and workflow processes. Our expert engineers are ready to design a custom part to meet your specific requirements, and we offer a wide variety of standard sizes, designs and configurations for our full line of easy-to-install components.

SFC KOENIG

Leader in
Sealing & Flow Control
Technology

Proven Precision & Reliability

SFC KOENIG components are proven effective in a diverse array of applications, and are the ideal solution wherever safe and secure sealing and flow control is needed. We maintain a variety of manufacturing and industry-specific certifications, and our engineers are ready to assist with a customised solution that meets your exact specifications and requirements. With over 3 billion parts installed, SFC KOENIG components are proven effective and are ready to meet your toughest sealing and flow control challenge.

FLUID POWER

SFC KOENIG parts are ideal for hydraulics, manifolds, mobile power units, valves, pumping and other fluid power systems. We deliver reliable, leak-free sealing and flow control, with tamper-proof designs that provide long life cycles and withstand the harshest environments.

TRANSPORTATION

Leading automotive and vehicle system manufacturers rely on SFC KOENIG solutions for optimised safety and reliability. We maintain IATF 16949 certification and our parts are proven reliable for the operational extremes and high-vibration levels found in engines, transmissions, turbo chargers, braking, fueling and transportation.

MEDICAL

Offering the highest levels of safety, security and dependability, SFC KOENIG components meet the strict requirements of medical, surgical, optical and dental applications. From life-saving equipment to environmental controls, our best-in-class performance is relied on in even the most mission-critical applications.

OFFSHORE & MARITIME

The corrosive, harsh conditions found in maritime and offshore applications are reliably handled by SFC KOENIG components. Our sealing and flow control solutions have been used a diverse array of applications, including shipping, natural gas compressors, pumps, fluid density probes and more.

AEROSPACE

The aviation and aerospace industries rely on SFC KOENIG components for lightweight, high-pressure performance. From flight controls to jet engines, our parts provide safe and effective sealing and flow control in extreme environmental conditions.

Unrivaled Sealing & Flow Control Solutions

KOENIG EXPANDER®

The KOENIG EXPANDER® is the original one-piece, metal-to-metal sealing solution. With over 3 billion parts installed and a failure rate less than 1 PPM (part per million), these no-leak sealing plugs permanently resist pressures up to 500 bar and are proven effective – even for the sealing of angled channels and deep holes. The KOENIG EXPANDER® offers easy installation for a variety of applications and configurations, and is the industry's leading technology for the sealing of drilled holes.

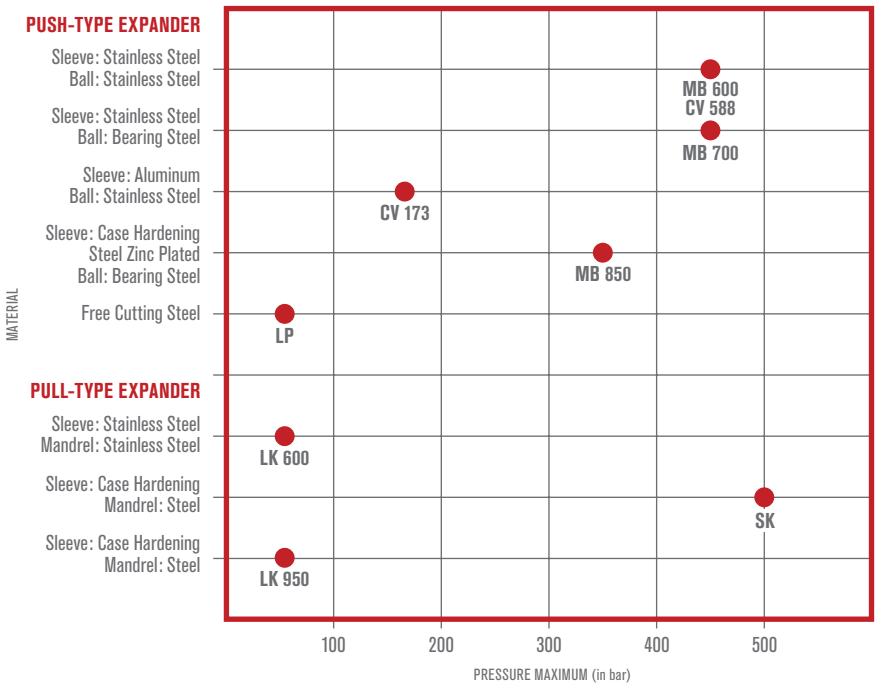
KOENIG CHECK VALVE®

With its self-contained, ball-style design and stainless steel construction, the KOENIG CHECK VALVE® provides precise flow control and minimal leakage, leveraging proven SFC KOENIG expander sleeve technology and flow control expertise to provide a highly-accurate solution. Available in a variety of sizes, cracking pressures, and in forward-flow and reverse-flow designs, the KOENIG CHECK VALVE® is effective for fast and dependable flow control.

KOENIG RESTRICTOR®

Designed for accurate flow control in even the most precise applications, the KOENIG RESTRICTOR® is ideal for deep-hole installations and wherever dependable, no leak fluid restriction is needed. The KOENIG RESTRICTOR® is available in a variety of orifice sizes customised for your flow rate, and is offered with or without an integrated screen, providing a reliable, one-piece flow control solution.

Material / Pressure

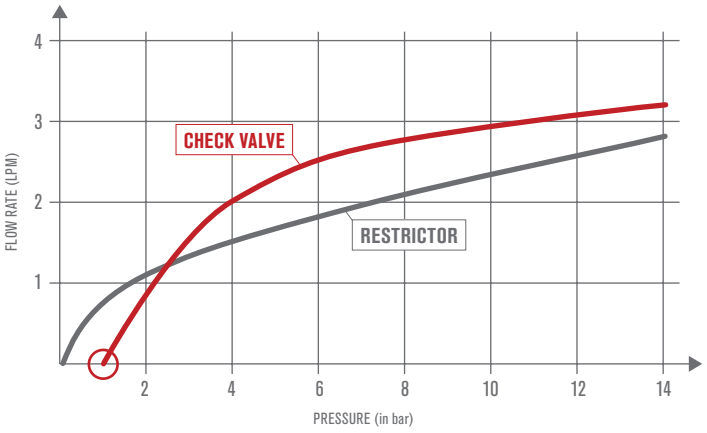


Flow Rate / Pressure

FUNCTIONS

CHECK VALVE
/ Opening Pressure:
Allow the flow from e.g. 1 bar
in flow direction ◯
/ Control fluid pressure in circuits
/ Backflow prevention

RESTRICTOR
/ Flow Limiter: Control the
amount of fluid being supplied
/ Orifice diameters customised
to your flow requirements



Contents

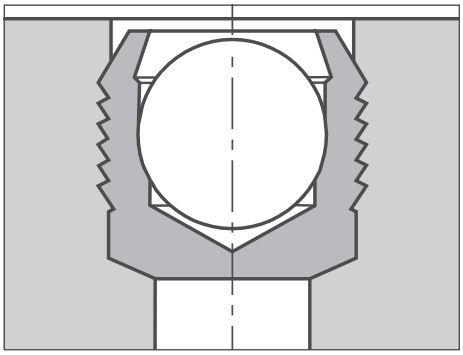
Contents

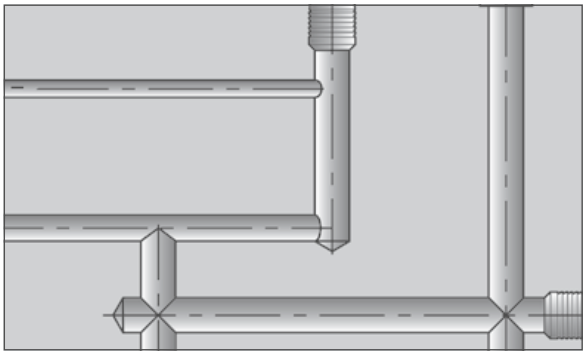
Koenig Expander® MB / CV Series

SFC KOENIG

Sealing Plugs for Operating Pressures up to 450 bar / 6500 psi

/ Operating pressures up to 450 bar / 6500 psi
/ Comprehensive range of products for Ø 3 – 22 mm, also available in inch version
/ Corrosion-resistant version
/ Available in aluminum
/ Standard drilling manufacturing tolerance 0 / + 0.10 mm
/ Swift and easy installation
/ Purely mechanical sealing through anchorage system





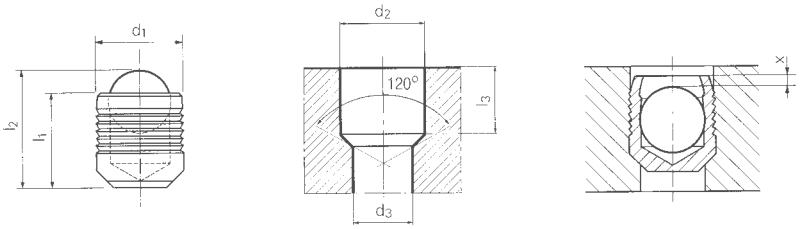
For large volume special applications, please contact the BONEHAM technical sales team.

RECOMMENDED SETTING EQUIPMENT FOR SERIES MB AND CV

EXPRESS 3000 / Hydropneumatic Table Press / See page 400 for more information
EXPRESS 5000 / Hydropneumatic Table Press / See page 400 for more information

MB 600 Series Sealing Plugs

Sleeve Clear Passivated per MIL-S-5002, Aerospace Quality



MATERIAL
/ Sleeve: Stainless Steel 1.4305
/ Ball: Stainless Steel 1.4301

IMPORTANT
/ See installation instructions on pages 415-416
/ Installation requirements on page 410

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.1 0	d_3 max.	l_3 min.	x ±0.2	Packaging Unit	Weight in gram/pcs.
MB600-030	3.0	3.6	4.6	3.0	2.2	3.4	0.4	100/1000	0.17
MB600-040	4.0	4.0	5.1	4.0	3.3	3.8	0.2	100/1000	0.34
MB600-050	5.0	5.5	7.1	5.0	4.3	5.3	0.4	100/1000	0.68
MB600-060	6.0	6.5	8.6	6.0	5.3	6.3	0.4	100/500	1.18
MB600-070	7.0	7.5	10.1	7.0	6.4	7.3	0.4	100/250	1.91
MB600-080	8.0	8.5	11.6	8.0	7.4	8.3	0.3	50/250	2.86
MB600-090	9.0	10.0	13.5	9.0	8.4	9.8	0.4	50/250	4.02
MB600-100	10.0	11.0	15.1	10.0	9.4	10.8	0.4	50/250	5.50
MB600-120	12.0	13.0	17.8	12.0	10.6	12.8	0.4	25/100	9.37
MB600-140	14.0	15.0	20.5	14.0	12.7	14.5	0.4	25/100	14.81

Dimensions in millimeters

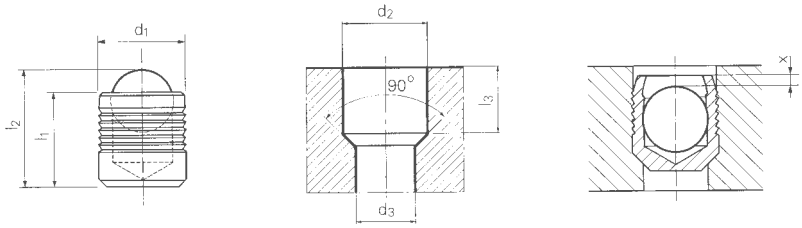
PRESSURE PERFORMANCE

Series MB 600 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10	1400 bar / 20300 psi **450 bar / 6500 psi**					1200 bar / 17400 psi **380 bar / 5500 psi**	
Ø 12 – 14	1000 bar / 14500 psi **350 bar / 5100 psi**					900 bar / 13000 psi **280 bar / 4100 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

MB 600 Series INCH Sealing Plugs

Sleeve Clear Passivated per MIL-S-5002, Aerospace Quality



MATERIAL
/ Sleeve: Stainless Steel 1.4305
/ Ball: Stainless Steel 1.4301 (1.4034 MB 600-093)

IMPORTANT
/ See installation instructions on pages 415-416
/ Installation requirements on page 410

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.1 0	d_3 max.	l_3 min.	x 0 -0.012	Packaging Unit	Weight in gram/pcs.
MB600-093A	0.093	0.100	0.120	0.0937	0.062	0.095	0.012	100/1000	0.07
MB600-125A	0.124	0.138	0.172	0.1250	0.093	0.125	0.012	100/1000	0.17
MB600-156A	0.156	0.150	0.196	0.1562	0.125	0.130	0.012	100/1000	0.31
MB600-187A	0.187	0.193	0.259	0.1875	0.156	0.152	0.012	100/500	0.53
MB600-218A	0.218	0.225	0.301	0.2187	0.187	0.187	0.012	100/500	0.86
MB600-250A	0.249	0.260	0.352	0.2500	0.218	0.212	0.012	100/500	1.26
MB600-281A	0.281	0.285	0.380	0.2812	0.250	0.250	0.012	100/500	1.87

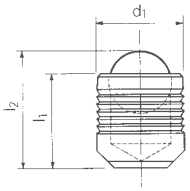
Dimensions in inches

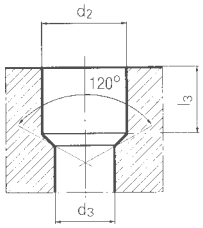
PRESSURE PERFORMANCE

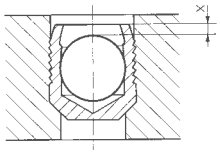
Series MB 600 Inch	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 0.093 – 0.281	1400 bar / 20300 psi **450 bar / 6500 psi**					1200 bar / 17400 psi **380 bar / 5500 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

MB 700 Series Sealing Plugs







MATERIAL
/ Sleeve: Stainless Steel 1.4305
/ Ball: Bearing Steel, Heat Treated

IMPORTANT
/ See installation instructions on pages 415-416
/ Installation requirements on page 410

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.1 0	d_3 max.	l_3 min.	x ±0.2	Packaging Unit	Weight in gram/pcs.
MB700-030	3.0	3.6	4.6	3.0	2.2	3.4	0.4	100/1000	0.17
MB700-040	4.0	4.0	5.2	4.0	3.3	3.8	0.2	100/2000	0.34
MB700-050	5.0	5.5	7.0	5.0	4.3	5.3	0.4	100/2000	0.68
MB700-060	6.0	6.5	8.6	6.0	5.3	6.3	0.4	100/2000	1.17
MB700-070	7.0	7.5	10.1	7.0	6.4	7.3	0.4	100/1000	1.90
MB700-080	8.0	8.5	11.6	8.0	7.4	8.3	0.3	50/1000	2.84
MB700-090	9.0	10.0	13.5	9.0	8.4	9.8	0.4	50/500	4.00
MB700-100	10.0	11.0	15.1	10.0	9.4	10.8	0.4	50/500	5.47
MB700-120	12.0	13.0	17.8	12.0	10.6	12.8	0.4	50/250	9.31
MB700-140	14.0	15.0	20.4	14.0	12.7	14.5	0.4	50/250	14.72
MB700-160	16.0	17.0	23.4	16.0	14.7	16.5	0.6	25/100	22.00
MB700-180	18.0	19.0	26.3	18.0	16.7	18.5	0.6	25/100	31.34
MB700-200	20.0	22.0	30.0	20.0	18.7	21.5	0.8	25/100	44.24
MB700-220	22.0	25.0	34.0	22.0	20.7	24.5	0.8	25/50	58.61

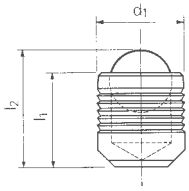
Dimensions in millimeters

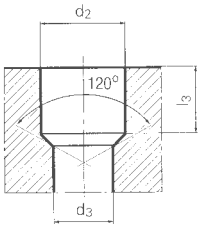
PRESSURE PERFORMANCE

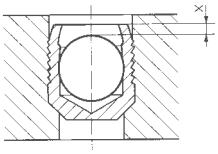
Series MB 700 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10	1400 bar / 20300 psi **450 bar / 6500 psi**					1200 bar / 17400 psi **380 bar / 5500 psi**	
Ø 12 – 22	1150 bar / 16700 psi **350 bar / 5100 psi**					900 bar / 13000 psi **280 bar / 4100 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

MB 850 Series Sealing Plugs







MATERIAL
/ Sleeve: Case Hardening Steel Zinc Plated, Thick Coat Passivated, CR (VI)-Free
/ Ball: Bearing Steel, Heat Treated

IMPORTANT
/ See installation instructions on pages 415-416
/ Installation requirements on page 410

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.1 0	d_3 max.	l_3 min.	x ±0.2	Packaging Unit	Weight in gram/pcs.
MB850-030	3.0	3.6	4.6	3.0	2.2	3.4	0.4	100/1000	0.17
MB850-040	4.0	4.0	5.2	4.0	3.3	3.8	0.2	100/2000	0.34
MB850-050	5.0	5.5	7.1	5.0	4.3	5.3	0.4	100/2000	0.68
MB850-060	6.0	6.5	8.6	6.0	5.3	6.3	0.4	100/2000	1.17
MB850-070	7.0	7.5	10.1	7.0	6.4	7.3	0.4	100/1000	1.91
MB850-080	8.0	8.5	11.6	8.0	7.4	8.3	0.3	50/1000	2.84
MB850-090	9.0	10.0	13.6	9.0	8.4	9.8	0.4	50/500	4.00
MB850-100	10.0	11.0	15.1	10.0	9.4	10.8	0.4	50/500	5.47
MB850-120	12.0	13.0	17.9	12.0	10.6	12.8	0.4	50/250	9.31
MB850-140	14.0	15.0	20.6	14.0	12.7	14.5	0.4	50/250	14.72
MB850-160	16.0	17.0	23.4	16.0	14.7	16.5	0.6	25/100	22.00
MB850-180	18.0	19.0	26.4	18.0	16.7	18.5	0.6	25/100	31.34
MB850-200	20.0	22.0	30.1	20.0	18.7	21.5	0.8	25/100	44.24
MB850-220	22.0	25.0	34.0	22.0	20.7	24.5	0.8	25/50	58.61

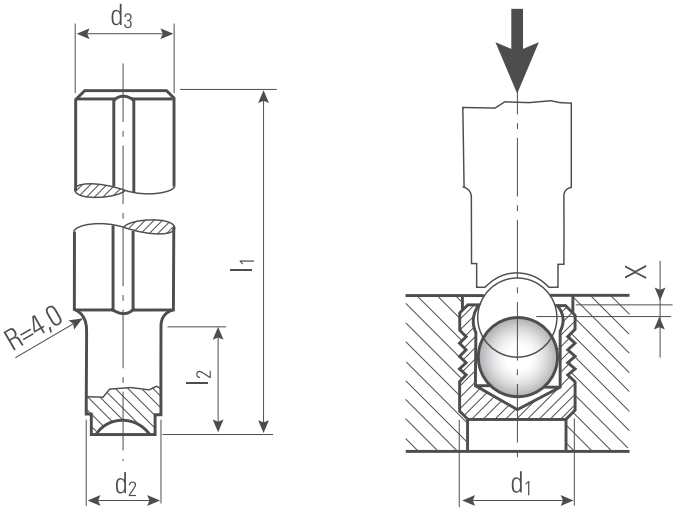
Dimensions in millimeters

PRESSURE PERFORMANCE

Series MB 850 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10	1100 bar / 16000 psi **350 bar / 5100 psi**					1000 bar / 14500 psi **320 bar / 4600 psi**	
Ø 12 – 22	900 bar / 13000 psi **280 bar / 4100 psi**					800 bar / 11600 psi **250 bar / 3600 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

MB Series Setting Tools



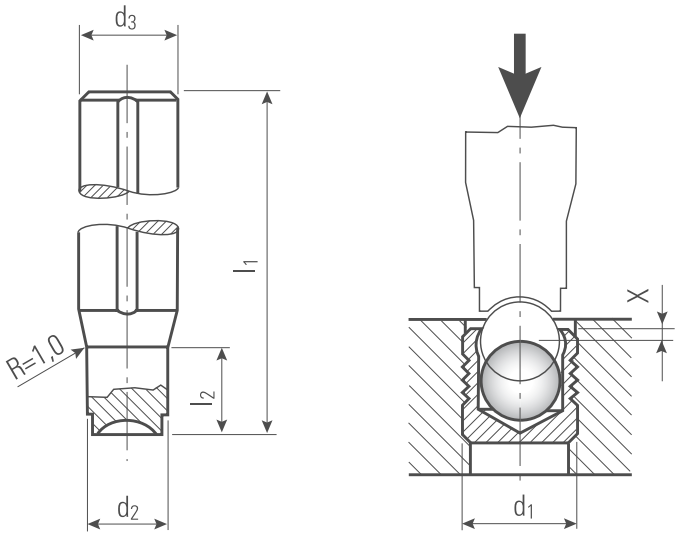
MATERIAL
/ Tool Steel, Heat Treated, Hardness Approx. HRC 50

RECOMMENDED SETTING EQUIPMENT FOR SERIES MB
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information
/ EXPRESS 5000 Hydropneumatic Table Press, see page 400 for more information

Part Number	d_1 Expander	d_3 -h9	l_1	d_2	l_2	x ±0.2	Weight in gram/pcs.
MB030	3.0	10	100	2.8	10	0.4	55
MB040	4.0	10	100	3.8	10	0.2	55
MB050	5.0	10	100	4.8	12	0.4	55
MB060	6.0	10	100	5.8	15	0.4	55
MB070	7.0	10	100	6.8	18	0.4	55
MB080	8.0	10	100	7.8	20	0.3	55
MB090	9.0	14	100	8.8	22	0.4	120
MB100	10.0	14	100	9.8	25	0.4	120
MB120	12.0	14	150	11.7	30	0.4	180
MB140	14.0	20	150	13.7	35	0.4	350
MB160	16.0	20	150	15.7	40	0.6	350
MB180	18.0	20	150	17.7	45	0.6	350
MB200	20.0	25	150	19.7	50	0.8	550
MB220	22.0	25	150	21.7	55	0.8	550

Dimensions in millimeters

MB Series INCH Setting Tools



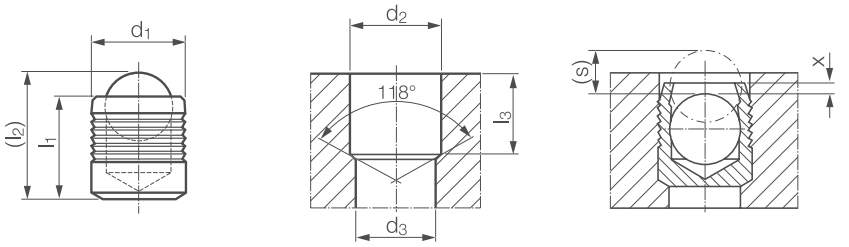
MATERIAL
/ Tool Steel, Heat Treated, Hardness Approx. HRC 50

RECOMMENDED SETTING EQUIPMENT FOR SERIES MB
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information
/ EXPRESS 5000 Hydropneumatic Table Press, see page 400 for more information

Part Number	d_1 Expander	d_3 -h9	l_1	d_2	l_2	x 0 -0.012	Weight in gram/pcs.
MB093A	0.093	0.394	3.94	0.082	0.137	0.012	55
MB125A	0.125	0.394	3.94	0.117	0.137	0.012	55
MB156A	0.156	0.394	3.94	0.148	0.137	0.012	55
MB187A	0.187	0.394	3.94	0.180	0.137	0.012	55
MB218A	0.218	0.394	3.94	0.211	0.400	0.012	55
MB250A	0.250	0.394	3.94	0.242	0.400	0.012	55
MB281A	0.281	0.394	3.94	0.273	0.400	0.012	55

Dimensions in inches

CV 173 Series Sealing Plugs



MATERIAL
/ Sleeve: Aluminum 2024-T4, QQ-A 225/6
/ Ball: Stainless Steel, AISI 302/304, Wax Film Lubrication (Diameter Dependant)

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.1 0	d_3 max.	l_3 min.	x ±0.2	(s) ~ Ref.	Packaging Unit	Weight in gram/pcs.
CV173-030	3.0	3.18	4.1	3.0	2.3	2.9	0.2	1.0	100/1000	0.09
CV173-040	4.0	4.00	5.2	4.0	3.3	3.8	0.2	1.4	100/1000	0.20
CV173-050	5.0	5.50	7.0	5.0	4.3	5.3	0.2	1.9	100/1000	0.44
CV173-060	6.0	6.50	8.6	6.0	5.3	6.3	0.2	2.3	100/1000	0.78
CV173-070	7.0	7.50	10.1	7.0	6.2	7.3	0.2	2.8	100/1000	1.28
CV173-080	8.0	8.50	11.7	8.0	7.2	8.3	0.2	3.4	100/1000	1.96
CV173-090	9.0	10.00	13.7	9.0	8.2	9.8	0.2	3.7	100/1000	2.88
CV173-100	10.0	11.00	15.2	10.0	9.2	10.8	0.2	4.2	100/500	4.01
CV173-120	12.0	13.00	18.0	12.0	11.0	12.8	0.2	5.1	50/250	7.06

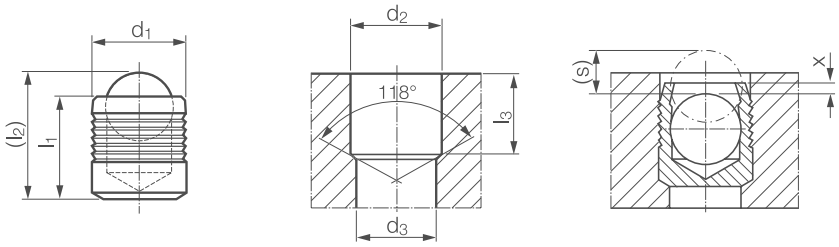
Dimensions in millimeters
Not all items in stock – MOQ and production lead times may apply

PRESSURE PERFORMANCE

Series CV 173 mm	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10				650 bar / 9400 psi **210 bar / 3000 psi**	
Ø 12				300 bar / 4300 psi **100 bar / 1500 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

CV 173 Series INCH Sealing Plugs



MATERIAL
/ Sleeve: Aluminum 2024-T4, QQ-A 225/6
/ Ball: Stainless Steel, AISI 302/304, Wax Film Lubrication (Diameter Dependant)

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.004 0	d_3 max.	l_3 min.	x ±0.004	(s) ~ Ref.	Packaging Unit	Weight in gram/pcs.
CV173-156	0.156	0.158	0.21	0.1562	0.130	0.149	0.008	0.053	100/1000	0.19
CV173-187	0.187	0.217	0.27	0.1875	0.160	0.208	0.010	0.066	100/1000	0.37
CV173-218	0.218	0.217	0.28	0.2187	0.190	0.208	0.010	0.078	100/1000	0.55
CV173-250	0.250	0.256	0.34	0.2500	0.220	0.247	0.010	0.094	100/1000	0.87
CV173-281	0.281	0.296	0.40	0.2812	0.250	0.287	0.010	0.110	100/1000	1.60
CV173-312	0.312	0.335	0.46	0.3125	0.281	0.326	0.010	0.129	100/1000	1.93
CV173-343	0.343	0.394	0.52	0.3437	0.312	0.385	0.010	0.140	100/500	2.58
CV173-375	0.375	0.394	0.54	0.3750	0.343	0.385	0.010	0.153	100/500	3.25
CV173-406	0.406	0.434	0.59	0.4062	0.375	0.425	0.010	0.162	100/500	4.20
CV173-437	0.437	0.512	0.68	0.4375	0.406	0.503	0.010	0.166	50/250	5.70

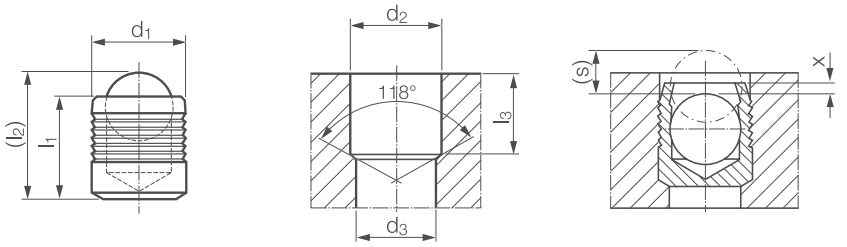
Dimensions in inches
Not all items in stock – MOQ and production lead times may apply

PRESSURE PERFORMANCE

Series CV 173 Inch	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 0.156 – 0.437				650 bar / 9400 psi **210 bar / 3000 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

CV 173 Series INCH Short Sealing Plugs



MATERIAL
/ Sleeve: Aluminum 2024-T4, QQ-A 225/6
/ Ball: Stainless Steel, AISI 302/304, Wax Film Lubrication (Diameter Dependant)

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.004 0	d_3 max.	l_3 min.	x ±0.004	(s) ~ Ref.	Packaging Unit	Weight in gram/pcs.
CV173-125S	0.125	0.125	0.16	0.1250	0.100	0.113	0.007	0.042	100/1000	0.10
CV173-156S	0.156	0.125	0.17	0.1562	0.130	0.113	0.000	0.040	100/1000	0.15
CV173-187S	0.187	0.187	0.24	0.1875	0.160	0.170	0.010	0.066	100/1000	0.33
CV173-218S	0.218	0.187	0.25	0.2187	0.190	0.170	0.000	0.063	100/1000	0.46
CV173-250S	0.250	0.225	0.30	0.2500	0.220	0.196	0.000	0.083	100/1000	0.76
CV173-281S	0.281	0.255	0.35	0.2812	0.250	0.233	0.000	0.091	100/1000	1.08
CV173-312S	0.312	0.280	0.39	0.3125	0.281	0.255	0.000	0.107	100/1000	1.52
CV173-343S	0.343	0.307	0.43	0.3437	0.312	0.275	0.000	0.118	100/500	2.01
CV173-406S	0.406	0.365	0.52	0.4062	0.375	0.308	-0.010	0.143	100/500	3.59

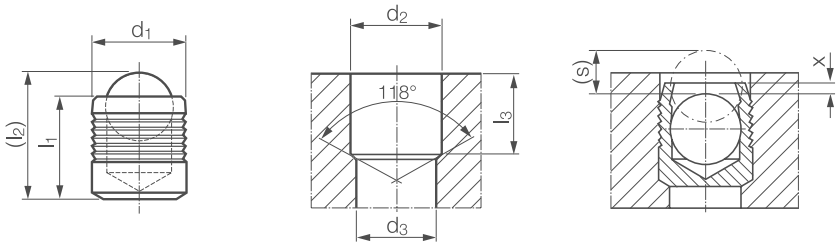
Dimensions in inches
Not all items in stock – MOQ and production lead times may apply

PRESSURE PERFORMANCE

Series CV 173 Inch Short	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 0.125 – 0.406				400 bar / 5800 psi **150 bar / 2100 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

CV 588 Series Sealing Plugs



MATERIAL
/ Sleeve: Stainless Steel (316) ASTM A580, Passivate, QQ-P-35C
/ Ball: Stainless Steel, AISI 316, Wax Film Lubrication (Diameter Dependant)

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.1 0	d_3 max.	l_3 min.	x ±0.1	(s) ~ Ref.	Packaging Unit	Weight in gram/pcs.
CV588-040	4.0	4.00	5.2	4.0	3.3	3.8	0.2	1.4	100/1000	0.36
CV588-050	5.0	5.50	7.0	5.0	4.3	5.3	0.2	1.9	100/1000	0.76
CV588-060	6.0	6.50	8.6	6.0	5.3	6.3	0.2	2.3	100/1000	1.28
CV588-070	7.0	7.50	10.1	7.0	6.2	7.3	0.2	2.8	100/1000	2.00
CV588-080	8.0	8.50	11.7	8.0	7.2	8.3	0.2	3.4	100/1000	2.96
CV588-090	9.0	10.00	13.7	9.0	8.2	9.8	0.2	3.7	100/1000	4.31
CV588-100	10.0	11.00	15.2	10.0	9.2	10.8	0.2	4.2	100/500	5.88

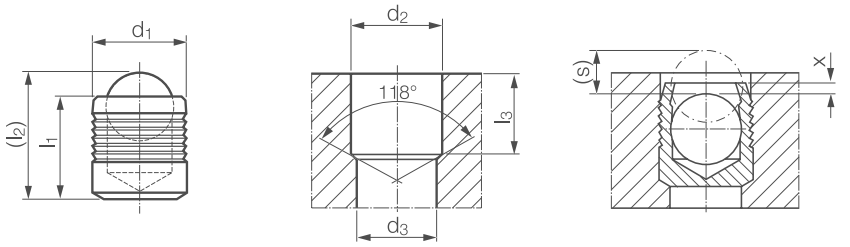
Dimensions in millimeters
Not all items in stock – MOQ and production lead times may apply

PRESSURE PERFORMANCE

Series CV 588 mm	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 9	1000 bar / 14500 psi **350 bar / 5000 psi**				
Ø 10	860 bar / 12500 psi **280 bar / 4000 psi**				

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

CV 588 Series INCH Sealing Plugs



MATERIAL
/ Sleeve: Stainless Steel (316) ASTM A580, Passivate, QQ-P-35C
/ Ball: Stainless Steel, AISI 316, Wax Film Lubrication (Diameter Dependant)

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.004 0	d_3 max.	l_3 min.	x ±0.004	(s) ~ Ref.	Packaging Unit	Weight in gram/pcs.
CV588-156	0.156	0.158	0.21	0.1562	0.130	0.149	0.008	0.053	500/1000	0.35
CV588-187	0.187	0.217	0.27	0.1875	0.160	0.208	0.010	0.066	100/1000	0.71
CV588-218	0.218	0.217	0.28	0.2187	0.190	0.208	0.010	0.078	100/1000	0.94
CV588-250	0.250	0.256	0.34	0.2500	0.220	0.247	0.010	0.094	100/1000	1.42
CV588-281	0.281	0.296	0.40	0.2812	0.250	0.287	0.010	0.110	100/1000	2.92
CV588-312	0.312	0.335	0.46	0.3125	0.281	0.326	0.010	0.129	100/1000	3.88
CV588-343	0.343	0.394	0.52	0.3437	0.312	0.385	0.010	0.140	100/500	4.11
CV588-375	0.375	0.394	0.54	0.3750	0.343	0.385	0.010	0.153	100/500	4.86

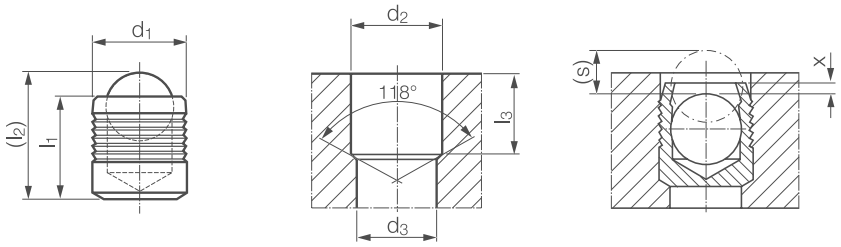
Dimensions in inches
Not all items in stock – MOQ and production lead times may apply

PRESSURE PERFORMANCE

Series CV 588 Inch	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 0.156 – 0.375	1000 bar / 14500 psi **350 bar / 5000 psi**				

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

CV 588 Series INCH Short Sealing Plugs



MATERIAL
/ Sleeve: Stainless Steel (316) ASTM A580, Passivate, QQ-P-35C
/ Ball: Stainless Steel, AISI 316, Wax Film Lubrication (Diameter Dependant)

Part Number	d_1	l_1	(l_2) ~ Ref.	d_2 +0.004 0	d_3 max.	l_3 min.	x ±0.004	(s) ~ Ref.	Packaging Unit	Weight in gram/pcs.
CV588-125S	0.125	0.125	0.16	0.1250	0.100	0.113	0.007	0.042	100/1000	0.18
CV588-156S	0.156	0.125	0.17	0.1562	0.130	0.113	0.000	0.040	100/1000	0.29
CV588-187S	0.187	0.187	0.24	0.1875	0.160	0.170	0.010	0.066	100/1000	0.60
CV588-218S	0.218	0.187	0.25	0.2187	0.190	0.170	0.000	0.063	100/1000	0.81
CV588-250S	0.250	0.225	0.30	0.2500	0.220	0.196	0.000	0.083	100/1000	1.20
CV588-281S	0.281	0.255	0.35	0.2812	0.250	0.233	0.000	0.091	100/1000	1.77

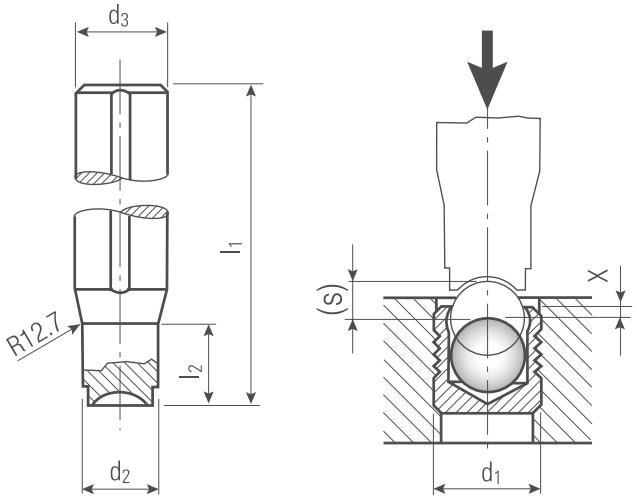
Dimensions in inches
Not all items in stock – MOQ and production lead times may apply

PRESSURE PERFORMANCE

Series CV 588 Inch Short	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 0.125 – 0.281	560 bar / 8100 psi **250 bar / 3600 psi**				

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

MB / CV Series Setting Tools



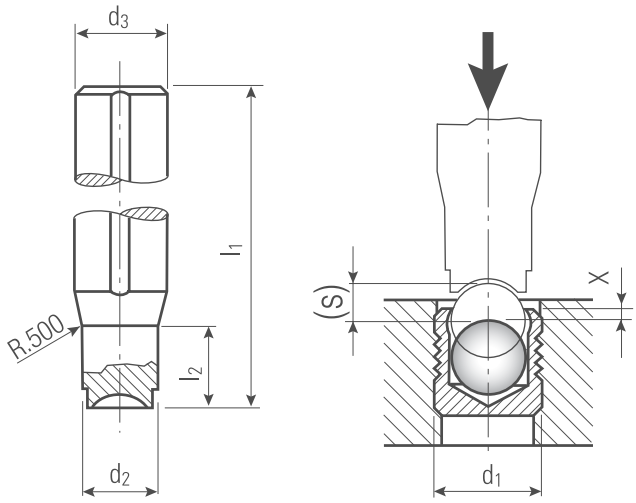
MATERIAL
/ Tool Steel, Heat Treated, Hardness Approx. HRC 50

RECOMMENDED SETTING EQUIPMENT FOR SERIES MB/CV
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information
/ EXPRESS 5000 Hydropneumatic Table Press, see page 400 for more information

Part Number	d_1 Expander	d_3 ±0.004	l_1	d_2	l_2	x ±0.10	(s) ~ Ref.	Weight in gram/pcs.
HT-MBM-030	MB/CV XXX-030	9.53	127	2.8	7.6	0.2	1.0	62
HT-MBM-040	MB/CV XXX-040	9.53	127	3.8	7.6	0.2	1.4	63
HT-MBM-050	MB/CV XXX-050	9.53	127	4.8	12.7	0.2	1.9	62
HT-MBM-060	MB/CV XXX-060	9.53	127	5.8	15.2	0.2	2.3	63
HT-MBM-070	MB/CV XXX-070	9.53	127	6.8	20.3	0.2	2.8	63
HT-MBM-080	MB/CV XXX-080	9.53	127	7.8	33.0	0.2	3.4	63
HT-MBM-090	MB/CV XXX-090	12.70	127	8.8	38.1	0.2	3.7	102
HT-MBM-100	MB/CV XXX-100	12.70	127	9.8	38.1	0.2	4.2	107
HT-MBM-120	MB/CV XXX-120	12.70	127	11.7	38.1	0.2	5.1	118
HT-MBM-140	MB/CV XXX-140	15.88	127	13.7	45.7	0.2	5.9	174
HT-MBM-160	MB/CV XXX-160	15.88	127	15.7	45.7	0.2	6.4	192
HT-MBM-180	MB/CV XXX-180	19.05	127	17.7	45.7	0.2	7.2	264
HT-MBM-200	MB/CV XXX-200	22.23	127	19.7	45.7	0.2	8.4	347
HT-MBM-220	MB/CV XXX-220	25.40	127	21.7	45.7	0.2	9.5	442

Dimensions in millimeters

MB / CV Series Setting Tools



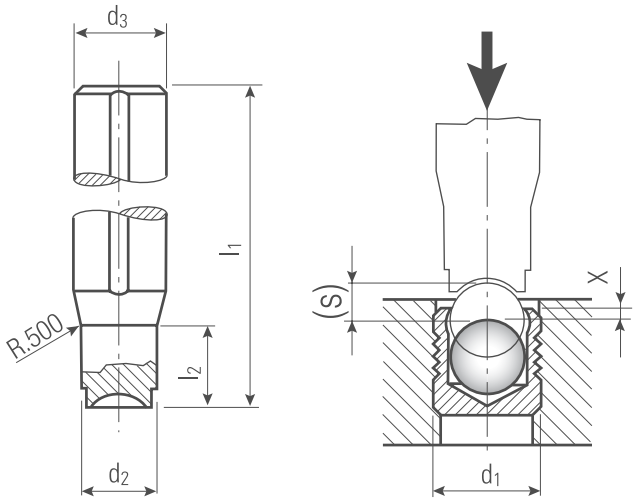
MATERIAL
/ Tool Steel, Heat Treated, Hardness Approx. HRC 50

RECOMMENDED SETTING EQUIPMENT FOR SERIES MB/CV
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information
/ EXPRESS 5000 Hydropneumatic Table Press, see page 400 for more information

Part Number	d_1 Expander	d_3 ±0.005	l_1	d_2	l_2	x ±0.004	(s) ~ Ref.	Weight in gram/pcs.
HT-CVI-156	CV XXX-156	0.375	5.0	0.142	0.3	0.008	0.053	63
HT-CVI-187	CV XXX-187	0.375	5.0	0.173	0.4	0.010	0.066	63
HT-CVI-218	CV XXX-218	0.375	5.0	0.204	0.5	0.010	0.063	63
HT-CVI-250	CV XXX-250	0.375	5.0	0.236	0.6	0.010	0.083	63
HT-CVI-281	CV XXX-281	0.375	5.0	0.267	0.8	0.010	0.110	63
HT-CVI-312	CV XXX-312	0.375	5.0	0.298	1.3	0.010	0.107	62
HT-CVI-343	CV XXX-343	0.500	5.0	0.329	1.5	0.010	0.140	100
HT-CVI-375	CV XXX-375	0.500	5.0	0.361	1.5	0.010	0.153	104
HT-CVI-406	CV XXX-406	0.500	5.0	0.392	1.5	0.010	0.162	108
HT-CVI-437	CV XXX-437	0.500	5.0	0.423	1.5	0.010	0.166	112

Dimensions in inches

MB / CV Series Short Setting Tools



MATERIAL
/ Tool Steel, Heat Treated, Hardness Approx. HRC 50

RECOMMENDED SETTING EQUIPMENT FOR SERIES MB/CV
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information
/ EXPRESS 5000 Hydropneumatic Table Press, see page 400 for more information

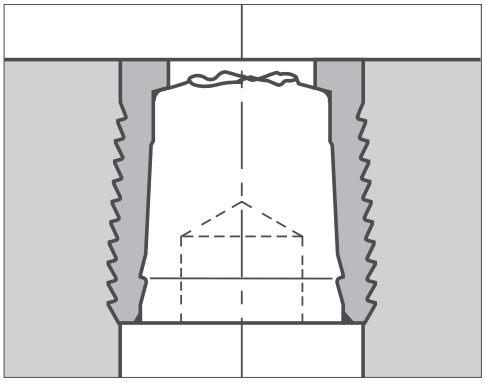
Part Number	d_1 Expander	d_3 ±0.005	l_1	d_2	l_2	x ±0.004	(s) ~ Ref.	Weight in gram/pcs.
HT-CVI-125	CV XXX-125S	0.375	5.0	0.111	0.3	0.007	0.042	62
HT-CVI-156-S	CV XXX-156S	0.375	5.0	0.142	0.3	0.000	0.040	63
HT-CVI-187	CV XXX-187S	0.375	5.0	0.173	0.4	0.010	0.066	63
HT-CVI-218	CV XXX-218S	0.375	5.0	0.204	0.5	0.010	0.063	63
HT-CVI-250	CV XXX-250S	0.375	5.0	0.236	0.6	0.010	0.083	63
HT-CVI-281-S	CV XXX-281S	0.375	5.0	0.267	0.8	0.000	0.091	63
HT-CVI-312	CV XXX-312S	0.375	5.0	0.298	1.3	0.010	0.107	62
HT-CVI-343	CV XXX-343S	0.500	5.0	0.329	1.5	0.010	0.118	100
HT-CVI-406	CV XXX-406S	0.500	5.0	0.392	1.5	0.010	0.143	108

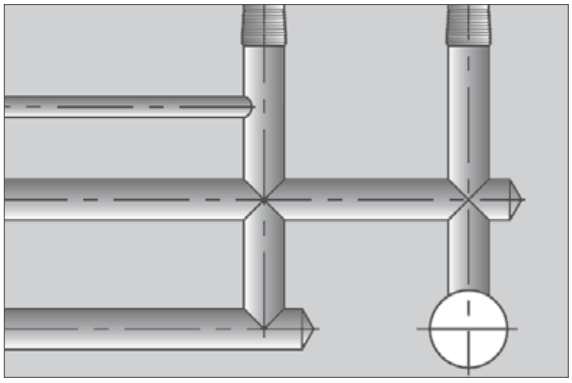
Dimensions in inches

Koenig Expander® SK Series

Sealing Plugs for Operating Pressures up to 500 bar / 7200 psi

/ Operating pressures up to 500 bar / 7200 psi
/ Short installation length
/ Liberal manufacturing tolerance 0 / + 0.12 mm
/ Direct installation into hydraulic bores
/ Purely mechanical sealing through anchorage system
/ Swift installation using convenient processing tools





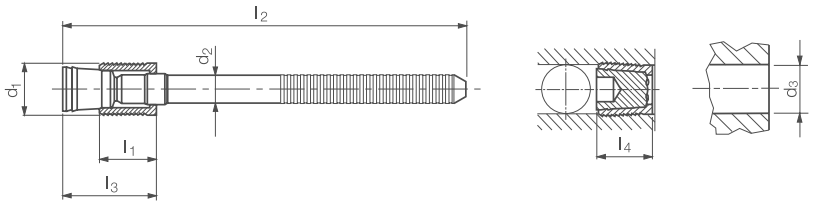
For large volume special applications, please contact the BONEHAM technical sales team.

RECOMMENDED SETTING EQUIPMENT FOR SERIES SK

KW-008 / Hand Lever Tool with Equipment Ø 4 – 6 mm / See page 406 for more information
EXTOOL-030 / Hydraulic/Pneumatic Tool / See page 401 for more information
EXTOOL-040-1 / Hydraulic/Pneumatic Tool / See page 402 for more information
EXTOOL-040-2 / Hydraulic/Pneumatic Tool / See page 403 for more information
EXTOOL-B-010 / Hydraulic/Pneumatic Tool / See page 405 for more information

SK 550 Series Sealing Plugs

One Piece Construction, Ideal for Automated High Production Requirements



MATERIAL
/ Sleeve: Case Hardening Steel, Gun Metal-Finish
/ Mandrel: Heat Treatable Steel, Special Oil Film Lubrication

IMPORTANT
/ See installation instructions on pages 417
/ Installation requirements on page 410

Part Number	d_1	l_1	d_2	l_2	l_3 max.	l_4 max.	d_3 +0.12 0	Packaging Unit	Weight in gram/pcs.
SK550-040	4.0	4.5	2.50	39	9.0	6.5	4.0	100/1000	1.71
SK550-050	5.0	5.5	3.00	41	10.0	7.5	5.0	100/1000	2.68
SK550-060	6.0	6.5	3.40	43	12.0	8.0	6.0	100/500	3.61
SK550-070	7.0	7.5	4.10	38	14.0	9.0	7.0	100/500	4.98
SK550-080	8.0	8.5	4.20	40	15.0	10.5	8.0	100/500	6.33
SK550-090	9.0	9.5	4.50	43	17.0	11.0	9.0	100/250	8.23
SK550-100	10.0	10.5	4.75	45	19.0	12.5	10.0	100/250	10.57
SK550-120	12.0	12.5	5.70	50	24.0	16.5	12.0	50/250	16.77

Dimensions in millimeters

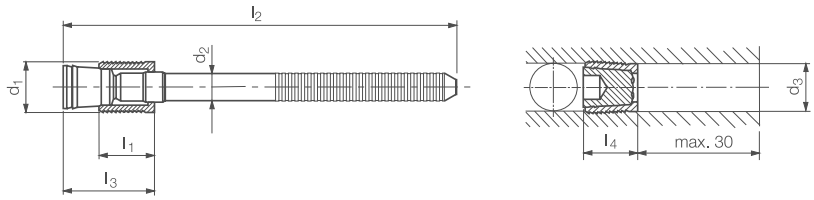
PRESSURE PERFORMANCE

Series SK 552 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 10	1600 bar / 23200 psi **500 bar / 7200 psi**					1400 bar / 20300 psi **450 bar / 6500 psi**	
Ø 12	1600 bar / 23200 psi **400 bar / 5800 psi**						

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

SK 552 Series Long Mandrel Sealing Plugs

One Piece Construction, Ideal for Automated High Production Requirements
Special Type: With Mandrel 30mm Longer than Standard



MATERIAL
/ Sleeve: Case Hardening Steel, Gun Metal-Finish
/ Mandrel: Heat Treatable Steel, Special Oil Film Lubrication

IMPORTANT
/ See installation instructions on pages 417
/ Installation requirements on page 410

Part Number	d_1	l_1	d_2	l_2	l_3 max.	l_4 min.	d_3 +0.12 0	Packaging Unit	Weight in gram/pcs.
SK552-040	4.0	4.5	2.5	69	9.0	6.5	4.0	100/1000	2.87
SK552-050	5.0	5.5	3.0	71	10.0	7.5	5.0	100/500	4.32
SK552-060	6.0	6.5	3.4	73	12.0	8.0	6.0	100/500	5.65
SK552-070	7.0	7.5	4.1	68	14.0	9.0	7.0	100/250	8.01
SK552-080	8.0	8.5	4.2	70	15.0	10.5	8.0	100/250	9.60
SK552-090	9.0	9.5	4.5	73	17.0	11.0	9.0	50/100	11.97
SK552-100	10.0	10.5	4.8	75	19.0	12.5	10.0	50/100	14.73

Dimensions in millimeters

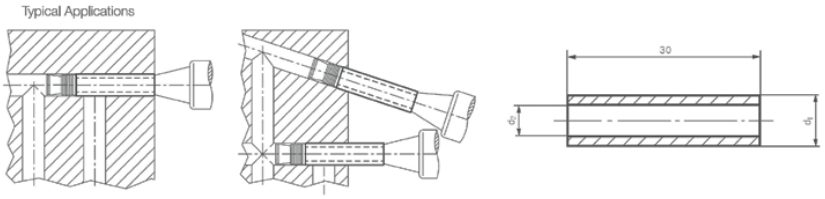
PRESSURE PERFORMANCE

Series SK 552 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 10	1600 bar / 23200 psi **500 bar / 7200 psi**					1400 bar / 20300 psi **450 bar / 6500 psi**	

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

SK Series Spacer Setting Tools SK552

For Setting KOENIG EXPANDER® SK with Mandrel 30mm Longer than Standard



MATERIAL
/ Case Hardening Steel, Case Hardened

RECOMMENDED SETTING EQUIPMENT FOR SERIES MB/CV
/ KW-008 Hand Lever Tool with Equipment Ø 4 – 6 mm, see page xx for more information
/ EXTOOL-030 Hydraulic/Pneumatic Tool, see page xx for more information
/ EXTOOL-040-1 Hydraulic/Pneumatic Tool, see page xx for more information
/ EXTOOL-040-2 Hydraulic/Pneumatic Tool, see page xx for more information
/ EXTOOL-B-010 Hydraulic/Pneumatic Tool, see page xx for more information

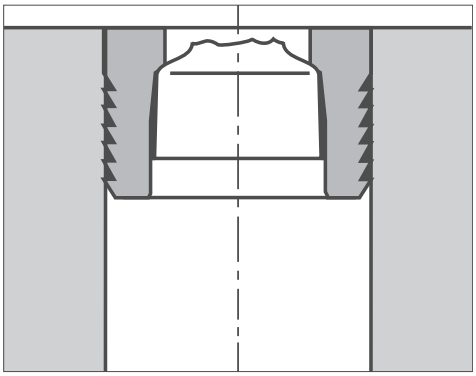
Part Number	d_1	d_2	Series SK	Weight in gram/pcs.
4X30-SK	4.0	2.7	SK552-040	2
5X30-SK	5.0	3.2	SK552-050	3
6X30-SK	6.0	3.7	SK552-060	5
7X30-SK	7.0	4.6	SK552-070	6
8X30-SK	8.0	4.8	SK552-080	8
9X30-SK	9.0	5.2	SK552-090	11
10X30-SK	10.0	5.6	SK552-100	13

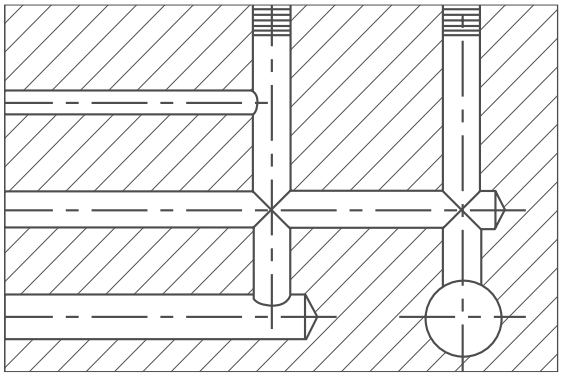
Dimensions in millimeters

Koenig Expander® LK Series

Sealing Plugs for Operating Pressures up to 60 bar / 850 psi

/ Operating pressures up to 60 bar / 850 psi
/ Short installation dimensions
/ Liberal manufacturing tolerance 0 / + 0.12 mm
/ Direct installation into hydraulic bore
/ Purely mechanical sealing through anchorage system
/ Installation using convenient processing tools
/ Comprehensive product range for Ø 4 – 20mm



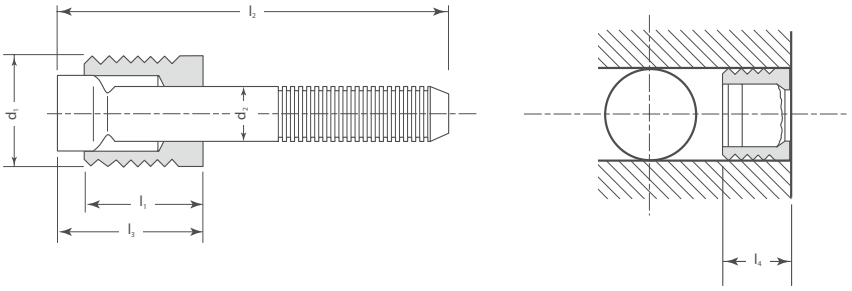


For large volume special applications, please contact the BONEHAM technical sales team.

RECOMMENDED SETTING EQUIPMENT FOR SERIES LK

KW-008 / Hand Lever Tool with Equipment Ø 4 – 6 mm / See page 406 for more information
EXTOOL-030 / Hydraulic/Pneumatic Tool / See page 401 for more information
EXTOOL-040-1 / Hydraulic/Pneumatic Tool / See page 402 for more information
EXTOOL-040-2 / Hydraulic/Pneumatic Tool / See page 403 for more information
EXTOOL-050 Hydraulic/Pneumatic Tool / See page 404 for more information
EXTOOL-B-010 / Hydraulic/Pneumatic Tool / See page 405 for more information

LK 600 Series Sealing Plugs



MATERIAL
/ Sleeve: Stainless Steel, Special Oil Film Lubrication
/ Mandrel: Stainless Steel, Special Oil Film Lubrication

IMPORTANT
/ See installation instructions on pages 418
/ Installation requirements on page 410

Part Number	d_1	l_1	d_2	l_2	d_3*	l_3 max.	l_4 max.	Packaging Unit	Weight in gram/pcs.
LK600-040	4.0	3.7	2.2	33	4.0	5.8	4.0	100/1000	1.19
LK600-050	5.0	4.5	2.5	36	5.0	7.1	4.8	100/1000	1.81
LK600-060	6.0	5.0	3.2	36	6.0	7.9	5.5	100/1000	2.95
LK600-070	7.0	5.5	3.8	32	7.0	8.8	5.8	100/500	3.70
LK600-080	8.0	6.5	4.3	34	8.0	10.5	7.0	100/500	5.26
LK600-100	10.0	7.0	4.9	34	10.0	11.0	7.5	100/500	7.65

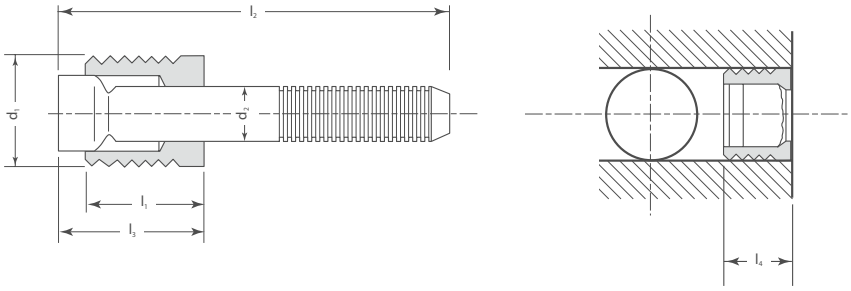
Dimensions in millimeters

PRESSURE PERFORMANCE

Series LK 600 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 10	180 bar / 2600 psi **60 bar / 850 psi**						

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

LK 950 Series Sealing Plugs



MATERIAL
/ Sleeve: Case Hardening Steel, Soft Annealed Gun Finish
/ Mandrel: Steel, Special Oil Film Lubrication

IMPORTANT
/ See installation instructions on pages 418
/ Installation requirements on page 410

Part Number	d_1	l_1	d_2	l_2	d_3 +0.12 0	l_3 max.	l_4 max.	Packaging Unit	Weight in gram/pcs.
LK950-040	4.0	3.7	2.2	36	4.0	5.5	4.0	100/1000	1.26
LK950-050	5.0	4.5	3.0	36	5.0	6.9	4.8	100/1000	2.28
LK950-060	6.0	5.0	3.4	36	6.0	7.4	5.3	100/1000	3.12
LK950-070	7.0	5.5	4.2	34	7.0	8.0	5.8	100/500	4.70
LK950-080	8.0	6.5	4.3	34	8.0	9.8	6.8	100/500	5.32
LK950-090	9.0	6.5	4.7	34	9.0	9.8	6.8	100/500	6.53
LK950-100	10.0	6.5	5.1	36	10.0	9.8	6.8	100/500	8.23
LK950-120	12.0	7.5	5.9	36	12.0	11.7	7.8	100/500	12.21
LK950-140	14.0	8.0	5.9	36	14.0	12.2	9.0	100/250	13.98
LK950-160	16.0	10.5	5.9	42	16.0	16.0	11.5	100/250	21.17
LK950-180	18.0	11.0	6.60	50.0	18.0	17.7	13.0	100/200	29.99
LK950-200	20.0	11.0	6.60	50.0	20.0	17.7	13.0	50/125	34.55

Dimensions in millimeters
**In base materials with high hardness or hardened materials:*
< 280HB the bore tolerance should be 0 / +0.12
≥ 280HB the bore tolerance should be +0.05 / +0.15

PRESSURE PERFORMANCE

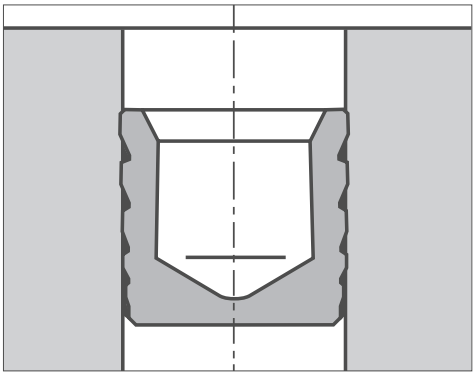
Series LK 950 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 20	180 bar / 2600 psi **60 bar / 850 psi**						

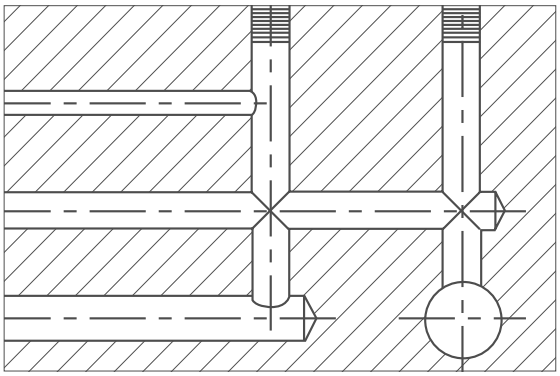
Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

Koenig Expander® LP Series

Sealing Plugs for Operating Pressures up to 60 bar / 850 psi

/ Operating pressures up to 60 bar / 850 psi
/ Short installation dimensions
/ Mechanical sealing using press fit
/ Quick installation



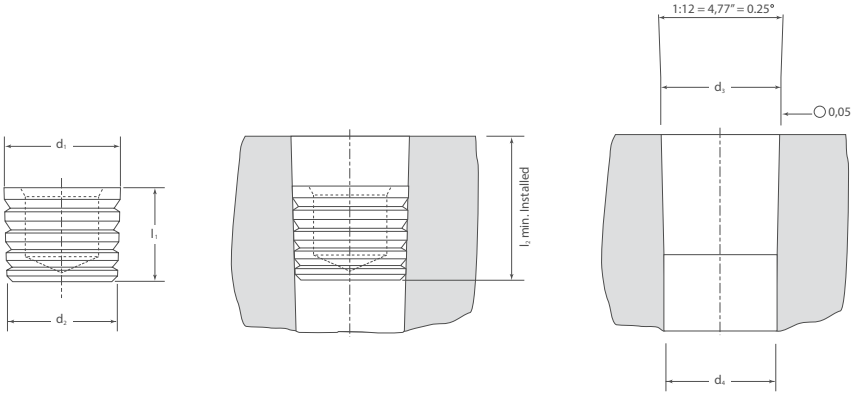


For large volume special applications, please contact the BONEHAM technical sales team.

RECOMMENDED SETTING EQUIPMENT FOR SERIES LP

EXPRESS 3000 / Hydropneumatic Table Press / See page 400 for more information
EXPRESS 5000 / Hydropneumatic Table Press / See page 400 for more information

LP 900 Series Sealing Plugs



MATERIAL
/ Free Cutting Steel
/ Nitrocarburized, Lubricated

IMPORTANT
/ See installation instructions on pages 419
/ Installation requirements on page 410

Part Number	d_1 Expander	d_2	l_1	d_3 min.	d_4 +0.1 -0.3	l_2 min.	Packaging Unit	Weight in gram/pcs.
LP900-040	4.40	3.7	5.0	4.55	4.0	7.0	1000/10000	0.35
LP900-050	5.40	4.7	6.0	5.55	5.0	8.0	1000/5000	0.63
LP900-060	6.40	5.7	6.0	6.55	6.0	8.5	500/2500	0.89
LP900-070	7.40	6.7	6.0	7.55	7.0	8.5	500/2500	1.20
LP900-080	8.45	7.7	7.0	8.60	8.0	9.5	250/2000	1.76
LP900-090	9.60	9.0	7.5	9.75	9.0	10.0	100/1000	2.30
LP900-100	10.65	10.0	8.5	10.80	10.0	11.0	100/1000	3.20
LP900-120	12.75	12.0	9.5	12.90	12.0	12.0	50/500	5.03

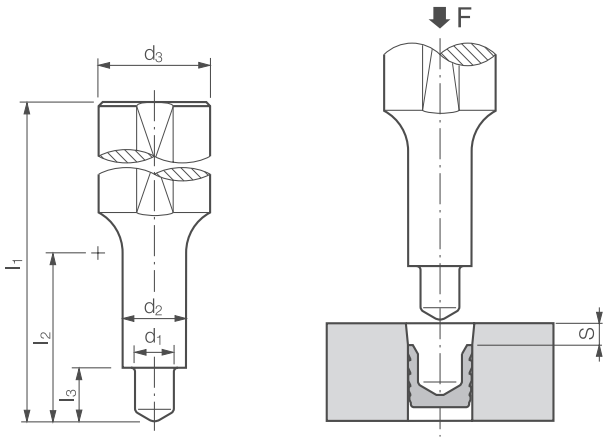
Dimensions in millimeters
Not all items in stock – MOQ and production lead times may apply
Please inquire with our sales team for larger LP 900 models

PRESSURE PERFORMANCE

Series LP 900 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 12	180 bar / 2600 psi **60 bar / 850 psi**						

Proof Pressure Test – Ⓑ
Max. Allowable Working Pressure = Nominal Pressure

LP Series Setting Tools



MATERIAL
/ Tool Steel, Heat Treated, Hardness Approx. HRC 50

RECOMMENDED SETTING EQUIPMENT FOR SERIES LP
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information
/ EXPRESS 5000 Hydropneumatic Table Press, see page 400 for more information

Part Number	d_1 Expander	d_1	d_2	d_3 -h9	l_1	l_2	l_3	(s) ~ Ref.	Weight in gram/pcs.
LP040	4.40	2.5	3.7	10.0	100	10	3.80	1.0	0.33
LP050	5.40	3.1	4.7	10.0	100	15	4.76	1.3	0.61
LP060	6.40	3.8	5.7	10.0	100	15	4.79	1.3	0.86
LP070	7.40	4.6	6.7	10.0	100	15	4.74	1.5	1.17
LP080	8.45	5.3	7.7	10.0	100	20	5.77	1.8	1.71
LP090	9.60	6.5	8.7	14.0	100	20	6.23	1.8	2.24
LP100	10.65	7.4	9.7	14.0	100	25	6.96	2.0	3.13
LP120	12.75	9.1	11.7	14.0	100	25	7.94	2.0	4.93

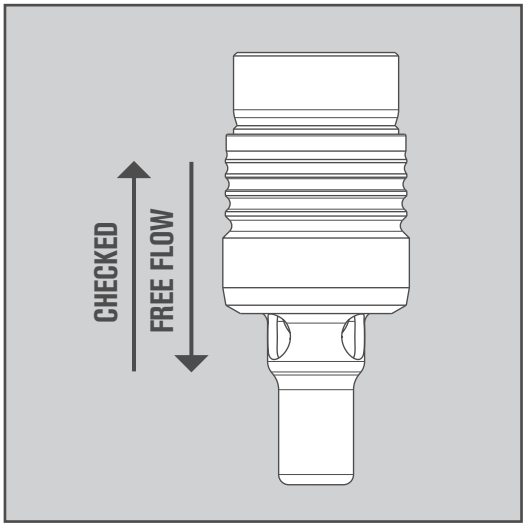
Dimensions in millimeters

Koenig Check Valve® BF / BR Series

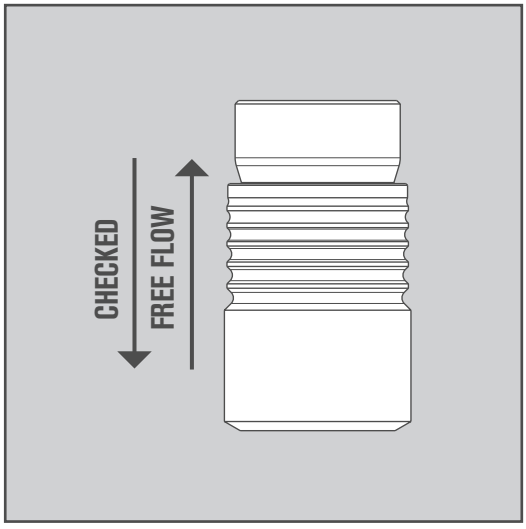
Max. Working Pressure Differential: 280 bar / 4060 psi in Checked Direction

/ Design based on the expansion principal
/ Modular concept: Forward Flow (BF) / Reverse Flow (BR)
/ Maximum working pressure differential: 280 bar / 4060 psi in checked direction
/ Available in standard sizes, with different opening pressures and screens
/ Specific customer solutions on request

CHECK VALVE FORWARD FLOW (BF)



CHECK VALVE REVERSE FLOW (BR)



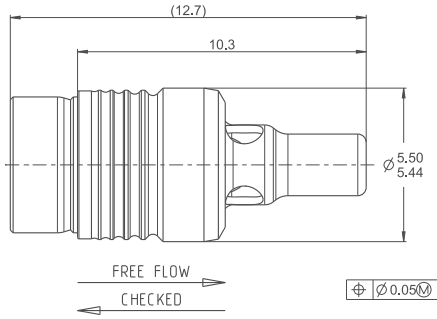
For large volume special applications, please contact the BONEHAM technical sales team.

RECOMMENDED SETTING EQUIPMENT FOR SERIES BF / BR

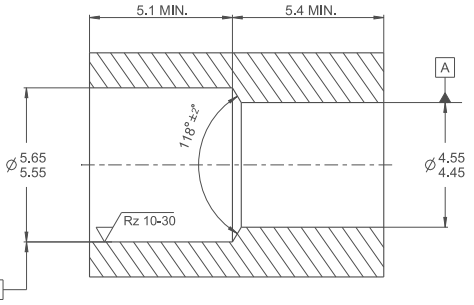
EXPRESS 3000 / Hydropneumatic Table Press / See page 400 for more information

BF Series 5.5mm Forward Check Valves

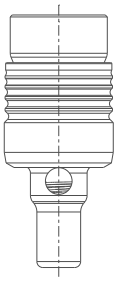
FORWARD FLOW CHECK VALVE



INSTALLATION HOLE

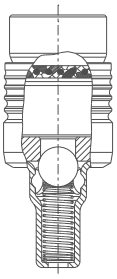


Dimensions in millimeters



CHECK VALVE FORWARD FLOW – UNSCREENED

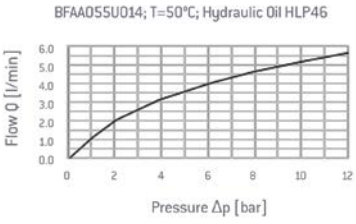
Part Number	Cracking Pressure (bar)
BFAA055U000	0.00 (no spring)
BFAA055U014	0.14 (± 0.05)
BFAA055U025	0.25 (± 0.10)
BFAA055U040	0.40 (± 0.30)
BFAA055U050	0.50 (± 0.30)
BFAA055U100	1.00 (± 0.30)
BFAA055U200	2.00 (± 0.30)



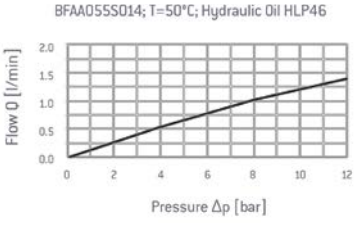
CHECK VALVE FORWARD FLOW – SCREENED

Part Number	Cracking Pressure (bar)
BFAA055S000	0.00 (no spring)
BFAA055S014	0.14 (± 0.05)
BFAA055S025	0.25 (± 0.10)
BFAA055S040	0.40 (± 0.30)
BFAA055S050	0.50 (± 0.30)
BFAA055S100	1.00 (± 0.30)
BFAA055S200	2.00 (± 0.30)

CHECK VALVE FLOW CURVE – UNSCREENED



CHECK VALVE FLOW CURVE – SCREENED



PERFORMANCE

Max. Installation Force	6200 N
Max. Working Pressure in Check Direction	280 bar
Max. Working Pressure in Flow Direction	40 bar
Max. Leakage on Air	20 sccm/min. @ 1.72 bar
Max. Leakage on Hydraulic Fluid (HLP46)	1 drop / min.
Cycle Test on Hydraulic Fluid (HLP46)	1 Mio. Cycles, 5 Hz, 6 bar, 50°C
Screen Size	125 Microns Absolute
Material of Test Body	EN-GJS-600-3

MATERIALS

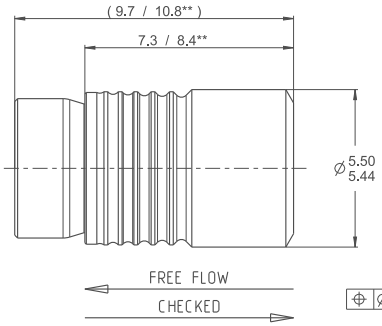
Sleeve	1.4305 / AISI 303
Pin	1.4021 / AISI 420A
Cage	1.4305 / AISI 303
Spring	1.4310 / AISI 301
Ball	1.3541 / AISI 420C
Screen	1.4401 / AISI 316L

SETTING TOOL

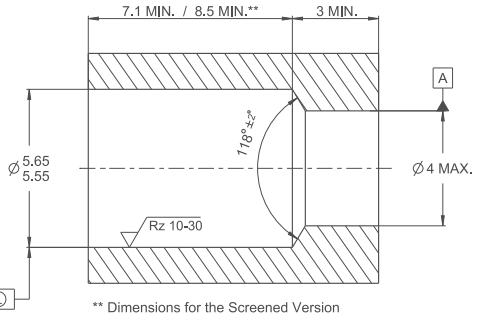
Check Valve Forward Flow – Unscreened	ST – 055 – 0335
Check Valve Forward Flow – Screened	ST – 055 – 0280

BR Series 5.5mm Reverse Check Valves

REVERSE FLOW CHECK VALVE

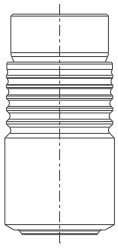


INSTALLATION HOLE



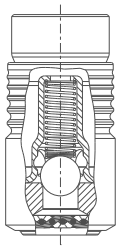
** Dimensions for the Screened Version

Dimensions in millimeters



CHECK VALVE REVERSE FLOW – UNSCREENED

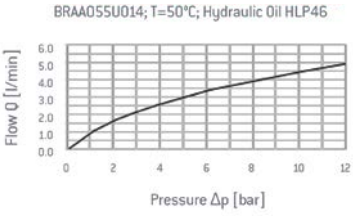
Part Number	Cracking Pressure (bar)
BRAA055U000	0.00 (no spring)
BRAA055U014	0.14 (± 0.05)
BRAA055U025	0.25 (± 0.10)
BRAA055U040	0.40 (± 0.30)
BRAA055U050	0.50 (± 0.30)
BRAA055U100	1.00 (± 0.30)
BRAA055U200	2.00 (± 0.30)



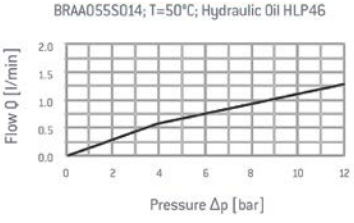
CHECK VALVE REVERSE FLOW – SCREENED

Part Number	Cracking Pressure (bar)
BRAA055S000	0.00 (no spring)
BRAA055S014	0.14 (± 0.05)
BRAA055S025	0.25 (± 0.10)
BRAA055S040	0.40 (± 0.30)
BRAA055S050	0.50 (± 0.30)
BRAA055S100	1.00 (± 0.30)
BRAA055S200	2.00 (± 0.30)

CHECK VALVE FLOW CURVE – UNSCREENED



CHECK VALVE FLOW CURVE – SCREENED



PERFORMANCE

Max. Installation Force	6200 N
Max. Working Pressure in Check Direction	280 bar
Max. Working Pressure in Flow Direction	40 bar
Max. Leakage on Air	20 sccm/min. @ 1.72 bar
Max. Leakage on Hydraulic Fluid (HLP46)	1 drop / min.
Cycle Test on Hydraulic Fluid (HLP46)	1 Mio. Cycles, 5 Hz, 6 bar, 50°C
Screen Size	125 Microns Absolute
Material of Test Body	EN-GJS-600-3

MATERIALS

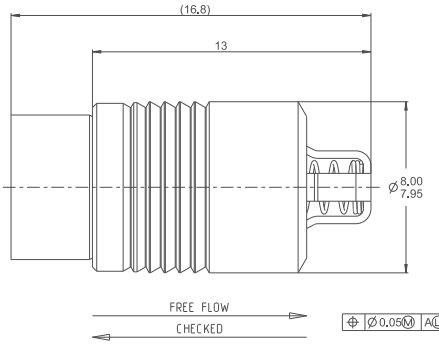
Sleeve	1.4305 / AISI 303
Pin	1.4021 / AISI 420A
Cage	1.4305 / AISI 303
Spring	1.4310 / AISI 301
Ball	1.3541 / AISI 420C
Screen	1.4401 / AISI 316L

SETTING TOOL

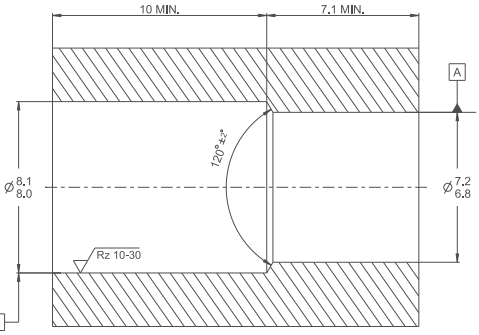
Check Valve Forward Flow – Unscreened	ST – 055 – 0335
Check Valve Forward Flow – Screened	ST – 055 – 0335

BF Series 8.0mm Forward Check Valves

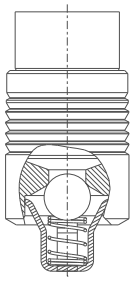
FORWARD FLOW CHECK VALVE



INSTALLATION HOLE



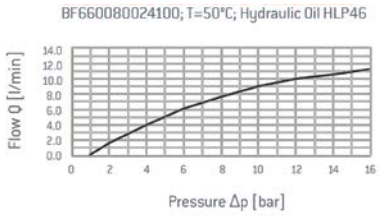
Dimensions in millimeters



CHECK VALVE FORWARD FLOW – UNSCREENED

Part Number	Cracking Pressure (bar)
BF660080024000	0.00 (no spring)
BF660080024014	0.14 (± 0.05)
BF660080024040	0.40 (± 0.30)
BF660080024100	1.00 (± 0.30)

CHECK VALVE FLOW CURVE – UNSCREENED



PERFORMANCE

Max. Installation Force	8000 N
Max. Working Pressure in Check Direction	280 bar
Max. Working Pressure in Flow Direction	40 bar
Max. Leakage on Air	20 sccm/min. @ 1.72 bar
Max. Leakage on Hydraulic Fluid (HLP46)	1 drop / min.
Cycle Test on Hydraulic Fluid (HLP46)	1 Mio. Cycles, 5 Hz, 6 bar, 50°C
Material of Test Body	EN-GJS-600-3

MATERIALS

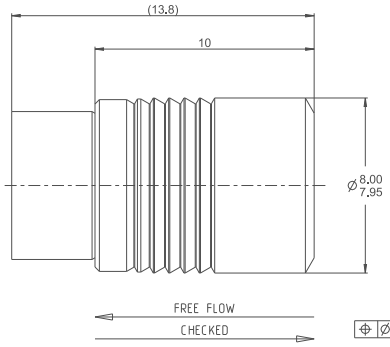
Sleeve	1.4305 / AISI 303
Pin	1.4542 / AISI 630
Cage	1.4310 / AISI 301
Spring	1.4310 / AISI 301
Ball	1.3541 / AISI 420C

SETTING TOOL

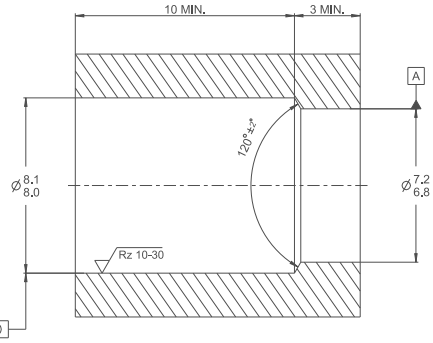
Check Valve Forward Flow – Unscreened	ST – 080 – 0380

BR Series 8.0mm Reverse Check Valves

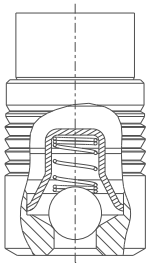
REVERSE FLOW CHECK VALVE



INSTALLATION HOLE



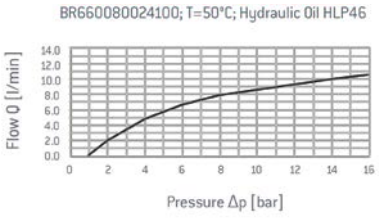
Dimensions in millimeters



CHECK VALVE FORWARD FLOW – UNSCREENED

Part Number	Cracking Pressure (bar)
BR660080024000	0.00 (no spring)
BR660080024014	0.14 (± 0.05)
BR660080024040	0.40 (± 0.30)
BR660080024100	1.00 (± 0.30)

CHECK VALVE FLOW CURVE – UNSCREENED



PERFORMANCE

Max. Installation Force	8000 N
Max. Working Pressure in Check Direction	280 bar
Max. Working Pressure in Flow Direction	40 bar
Max. Leakage on Air	20 sccm/min. @ 1.72 bar
Max. Leakage on Hydraulic Fluid (HLP46)	1 drop / min.
Cycle Test on Hydraulic Fluid (HLP46)	1 Mio. Cycles, 5 Hz, 6 bar, 50°C
Material of Test Body	EN-GJS-600-3

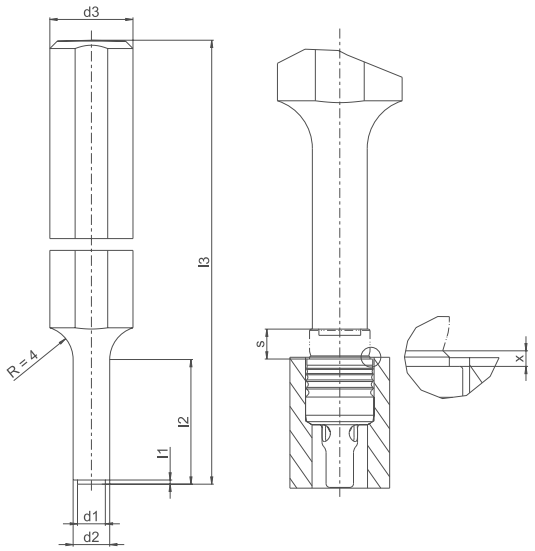
MATERIALS

Sleeve	1.4305 / AISI 303
Pin	1.4542 / AISI 630
Cage	1.4310 / AISI 301
Spring	1.4310 / AISI 301
Ball	1.3541 / AISI 420C

SETTING TOOL

Check Valve Forward Flow – Unscreened	ST – 080 – 0380

BF / BR Series Setting Tools



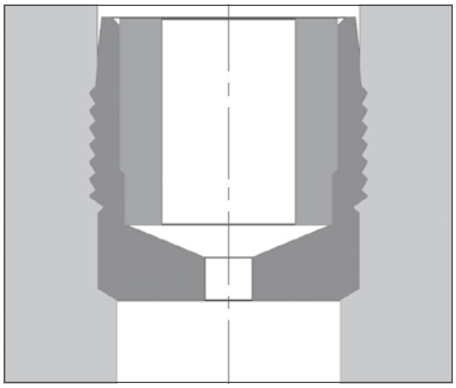
RECOMMENDED SETTING EQUIPMENT FOR SERIES BF AND BR
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information

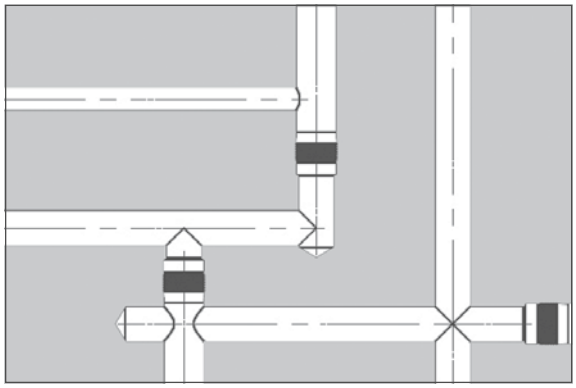
Part Number	Part Name	d_1 $^{\pm 0.05}$	d_2 $^{\pm 0.05}$	d_3 h9	l_1	l_2	l_3	x	(s)
ST–055–0280	Setting Tool 5.5	2.80	4.40	10.0	0.5 $^{+0.05}$	15	100	0 $^{+0.25}$	2.4
ST–055–0335	Setting Tool 5.5	3.35	4.40	10.0	0.5 $^{+0.05}$	15	100	0 $^{+0.25}$	2.4
ST–080–0380	Setting Tool 8.0	3.80	6.20	10.0	2.4 $^{\pm 0.10}$	20	100	0 $^{\pm 0.15}$	4.0

Dimensions in millimeters

Koenig Restrictor® RE Series

/ Expansion style restrictors
/ Can be used with fluids or gases
/ Standard restrictors in 300 series stainless steel
/ Orifices can be calculated to achieve desired flow rates
/ Expansion style easily installs into drilled holes and is tamper resistant



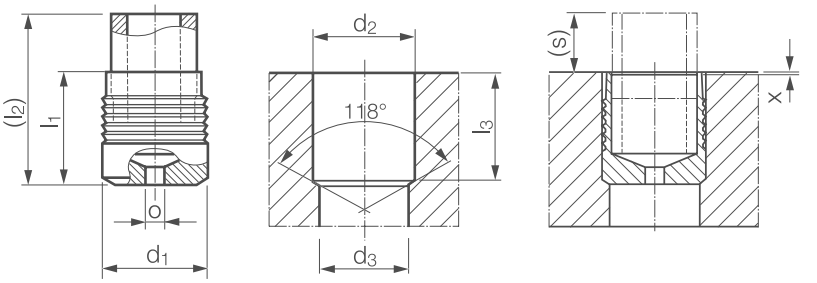


For large volume special applications, please contact the BONEHAM technical sales team.

RECOMMENDED SETTING EQUIPMENT FOR SERIES RE

EXPRESS 3000 / Hydropneumatic Table Press / See page 400 for more information
EXPRESS 5000 / Hydropneumatic Table Press / See page 400 for more information

RE Series Orifice Restrictors



MATERIAL
/ Stainless Steel AISI 303/304

PART NUMBER KEY
XXX is orifice diameter in hundredths of a millimeter, for example
127 for 1.27mm, with the decimal always in the same location.

Part Number	d_1	l_1	(l_2) ~ Ref.	O ±0.025 Orifice Diameter	d_2 +0.10 0	l_3 min.	d_3 max.	(s) ~ Ref.	x ±0.3	Packaging Unit
RE-040-XXX	4.0	4.0	6.0	0.40-1.27	4.0	3.9	3.3	2.0	0.0	100/1000
RE-050-XXX	5.0	5.5	8.2	0.40-1.91	5.0	5.4	4.3	2.7	0.0	100/1000
RE-060-XXX	6.0	6.5	9.9	0.40-2.54	6.0	6.4	5.3	3.4	0.0	100/1000
RE-070-XXX	7.0	7.5	11.6	0.40-3.30	7.0	7.4	6.2	4.1	0.0	100/1000
RE-080-XXX	8.0	8.5	13.3	0.40-3.81	8.0	8.4	7.2	4.8	0.0	100/1000
RE-090-XXX	9.0	10.0	15.5	0.40-4.32	9.0	9.9	8.2	5.5	0.0	100/1000
RE-100-XXX	10.0	11.0	17.1	0.40-4.95	10.0	10.9	9.2	6.1	0.0	50/250

Dimensions in millimeters

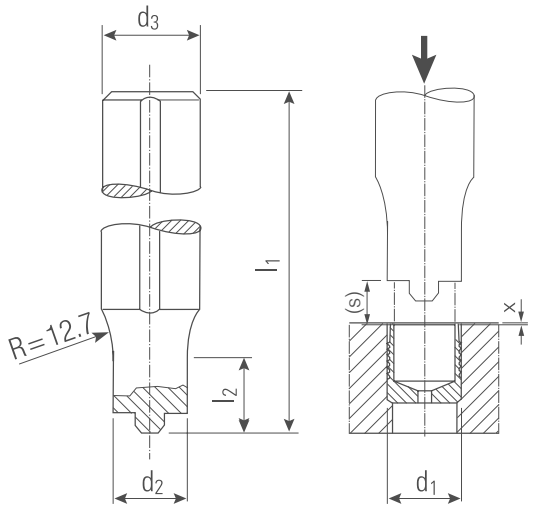
The weight depending on the orifice diameter
To calculate orifice diameter/length please refer to page 429
Not all items in stock – MOQ and production lead times may apply

PRESSURE PERFORMANCE

Series RE mm	Base Material of the Installation			
	❶ ETG-100 / 44SMn28 AISI 1144	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6*	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4	120 bar / 1740 psi			100 bar / 1450 psi
Ø 5	180 bar / 2610 psi			150 bar / 2175 psi
Ø 6	210 bar / 3045 psi			150 bar / 2175 psi
Ø 7-8	210 bar / 3045 psi			180 bar / 2610 psi
Ø 9-10	Please Contact Us for Details			

Max. Allowable Working Pressure = Nominal Pressure

RE Series Setting Tools



MATERIAL
/ Tool Steel, Heat Treated, Hardness Approx. HRC 50

RECOMMENDED SETTING EQUIPMENT FOR SERIES RE
/ EXPRESS 3000 Hydropneumatic Table Press, see page 400 for more information
/ EXPRESS 5000 Hydropneumatic Table Press, see page 400 for more information

Part Number	d_1 Series RE	d_3 ±0.20	l_1	d_2	l_2	(s) ~ Ref.	x ±0.30	Weight in gram/pcs.
HT-REM-040	RE-040-XXX	9.53	127	3.61	7.62	2.0	0.0	70
HT-REM-050	RE-050-XXX	9.53	127	4.78	12.70	2.7	0.0	70
HT-REM-060	RE-060-XXX	9.53	127	5.79	15.24	3.4	0.0	70
HT-REM-070	RE-070-XXX	9.53	127	6.78	20.32	4.1	0.0	70
HT-REM-080	RE-080-XXX	9.53	127	7.57	33.02	4.8	0.0	70
HT-REM-090	RE-090-XXX	12.70	127	8.36	38.10	5.5	0.0	70
HT-REM-100	RE-100-XXX	12.70	127	9.78	38.10	6.1	0.0	70

Dimensions in millimeters

Special Orders

In addition to our standard product line, BONEHAM and SFC KOENIG can provide customised parts and unique solutions specially designed for your installation.

Our in-house engineering staff is available to assist you with your needs. With decades of expertise in sealing we meet even the most unique requirements, producing parts that are tailored to your exact application. Our team includes some of the industry's most experienced engineers and manufacturing personnel, and we deliver the solutions others cannot.

From material to size to operation, we are able to customise our components to meet unique installations. With over 3 billion parts delivered to customers around the world, we are experts in sealing and flow control, and are ready to apply that knowledge to your order.

SFC KOENIG maintains failure rates less than 1 part per million, delivering reliable solutions with unmatched consistency. Our engineering expertise, quality controls and efficient manufacturing operations are designed to produce the highest quality parts for each customer's requirements.

SFC KOENIG brings more than 80 years of success to the design processes. From the initial design consultation to testing, production and process integration, we are ready to work with you to solve your unique sealing and flow control challenge.

Setting Tool Equipment

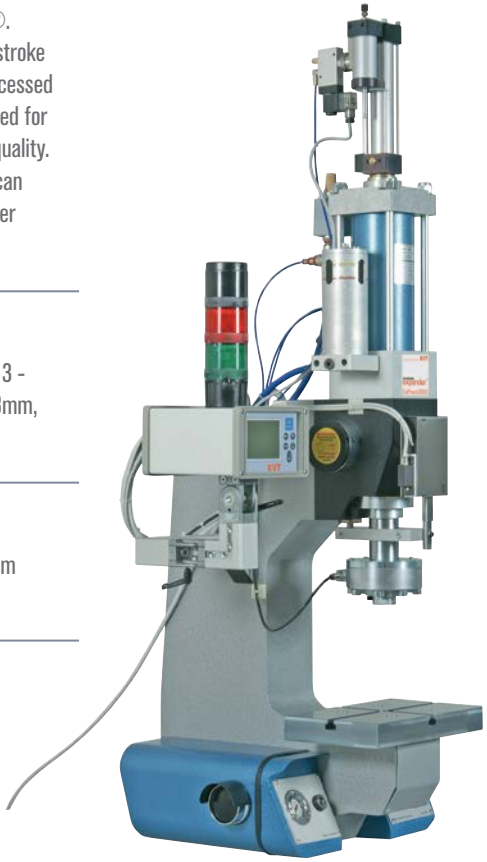
Setting Equipment for All Series

/ Express 3000 / Hydropneumatic Table Press
/ Express 5000 / Hydropneumatic Table Press
/ EXTOOL 030, 040-1, 040-2 and 050 / Hydraulic / Pneumatic Tool with Mandrel Collection Device
/ EXTOOL B-010 / Battery Tool with Mandrel Collection Device
/ KW-008 - Hand Lever Tool with Equipment Ø 4 – 6 mm

Express 3000 / 5000 Setting Tools

Hydropneumatic Table Press for Series MB / CV / LP / BF / BR / RE with Force and Distance Control

Hydropneumatic setting tool for the installation of KOENIG EXPANDER®. Quick tool change avoids long changeover times. The required working stroke is preprogrammed and can be retrieved by the Expander type to be processed (max. 64 memory locations). In addition, the working stroke is referenced for each individual Expander, which guarantees high process stability and quality. The press is force and distance controlled; an RS232 or USB interface can be used to trace corresponding data on the customer's computer for later processing. The required software is included in the scope of delivery.



EXPRESS 3000

For the installation of KOENIG EXPANDER Series MB, CV and LP from Ø 3 - 10mm (.093" - .375" inch), KOENIG CHECK VALVE BF and BR 5.5 and 8mm, and KOENIG RESTRICTOR Series RE from Ø 4 - 10mm.

EXPRESS 5000

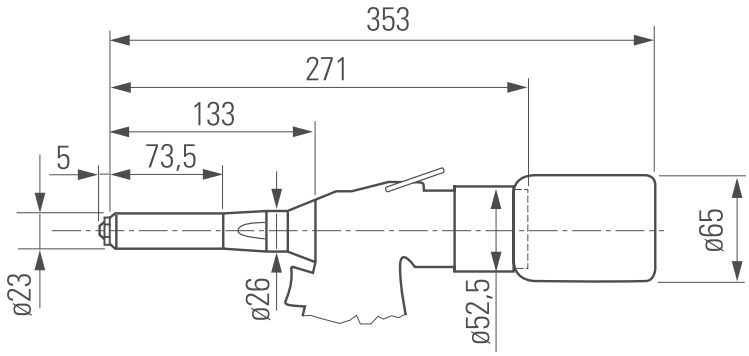
For the installation of KOENIG EXPANDER Series MB and CV Ø 12 - 22mm (.406" - .437" inch) and Series LP for Ø 12mm.

SETTING TOOL DATA

	Express 3000	Express 5000
Height	Approx 1360 mm	Approx. 1470 mm
Width	Approx. 340 mm (max. 530 mm)	Approx. 400 mm (max. 580 mm)
Depth	Approx. 495 mm	Approx. 535 mm
Table (width x depth)	220 x 160 mm	300 x 190 mm
Weight	approx. 140 kg	190 kg
Compressive force	30 kN (max force 29.5 kN at 6 bar)	50 kN (max force 52.5 kN at 6 bar)
Working stroke	10 mm (within the cylinder ram)	15 mm (within the cylinder ram)
Working speed	40 mm/sec (max. possible at 6 bar)	30 mm/sec (max. possible at 6 bar)
Working area (height)	250 mm (working height between table top and cylinder, without setting tool)	
Working area (depth)	200 mm (center-line spacing between cylinder and C frame)	
Cylinder ram	60 mm	
Operating voltage	230 V/110 V, automatic switchover to corresponding power supply	
Operation	VISUAL POINT terminal with QVGA graphic display	
Force / distance control	Sensor adjusted with SIT reference sensor	
Software	WINSCOPE Software for connecting to a PC	

EXTOOL-030 Setting Tool

Hydropneumatic Tool for Series LK / SK with Mandrel Collection Device



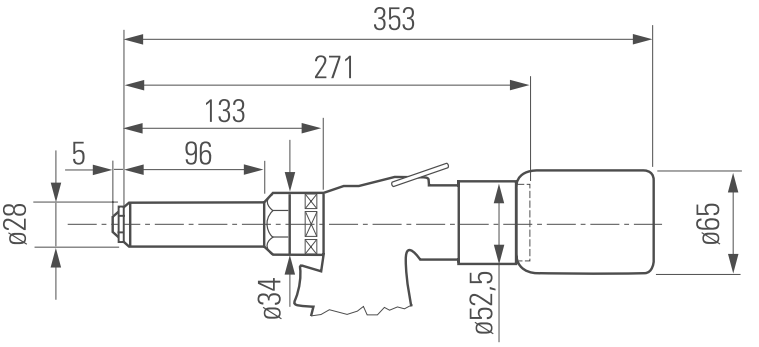
TECHNICAL DATA

Type	EXTOOL-030
Series	LK / SK
Order number	300160392
Weight	2.5 kg
Pull force at 7 bar	19 kN
Working stroke	25 mm
Air supply pressure (min. - max.)	5-7 bar
Air consumption at 5-6 bar	3.5 l
Noise level	< 75 dB(A)
Cycle time	2.0 s
Nosepiece (not included) LK600-040	300161993
Nosepiece (not included) Expander LK and SK Ø 4.0	300161899
Nosepiece (not included) Expander LK and SK Ø 5.0	300161901
Nosepiece (not included) Expander LK and SK Ø 6.0	300161902
Jaws Expander LK and SK Ø 4.0 - 6.0	300161883
Jaws case Expander LK and SK Ø 4.0 - 6.0	300161882
Jaws pusher Expander LK and SK Ø 4.0 - 6.0	300161884

Without nosepiece

EXTOOL-040-1 Setting Tool

Hydropneumatic Tool for Series LK / SK with Mandrel Collection Device



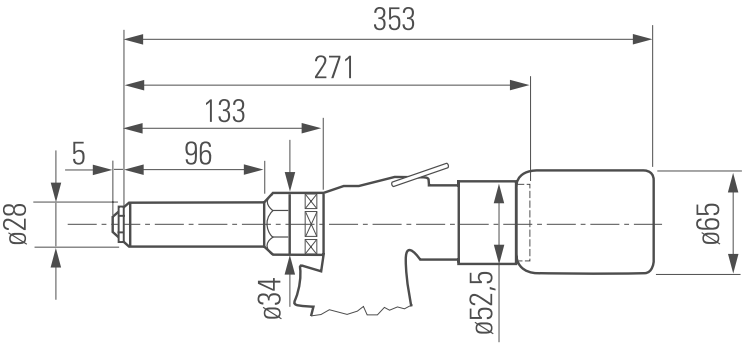
TECHNICAL DATA

Type	EXTOOL-040-1
Series	LK / SK
Order number	300160393
Weight	2.7 kg
Pull force at 7 bar	24 kN
Working stroke	18 mm
Air supply pressure (min. - max.)	5-7 bar
Air consumption at 5-6 bar	3.5 l
Noise level	< 75 dB(A)
Cycle time	2.0 s
Nosepiece (not included) Expander LK and SK Ø 7.0	300161911
Nosepiece (not included) Expander LK and SK Ø 8.0	300161912
Nosepiece (not included) Expander LK and SK Ø 9.0	300161913
Nosepiece (not included) Expander LK and SK Ø 10.0	300161914
Jaws Expander LK and SK Ø 7.0 - 10.0	300161903
Jaws case Expander LK and SK Ø 7.0 - 10.0	300161900
Jaws pusher Expander LK and SK Ø 7.0 - 10.0	300161905

Without nosepiece

EXTOOL-040-2 Setting Tool

Hydropneumatic Tool for Series LK / SK with Mandrel Collection Device



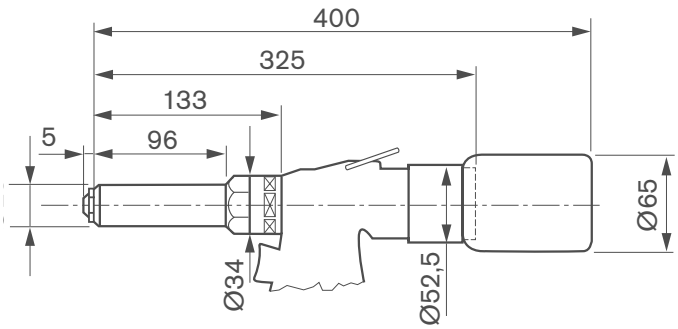
TECHNICAL DATA

Type	EXTOOL-040-2
Series	LK / SK
Order number	300160394
Weight	2.7 kg
Pull force at 7 bar	24 kN
Working stroke	18 mm
Air supply pressure (min. - max.)	5-7 bar
Air consumption at 5-6 bar	3.5 l
Noise level	< 75 dB(A)
Cycle time	2.0 s
Nosepiece (not included) Expander LK and SK Ø 12.0	300161931
Nosepiece (not included) Expander LK and SK Ø 14.0	300161932
Nosepiece (not included) Expander LK and SK Ø 16.0	300161933
Jaws Expander LK and SK Ø 12.0 - 16.0	300161930
Jaws case Expander LK and SK Ø 12.0 - 16.0	300161900
Jaws pusher Expander LK and SK Ø 12.0 - 16.0	300161905

Without nosepiece

EXTOOL-050 Setting Tool

Hydropneumatic Tool for Series LK / SK with Mandrel Collection Device



TECHNICAL DATA

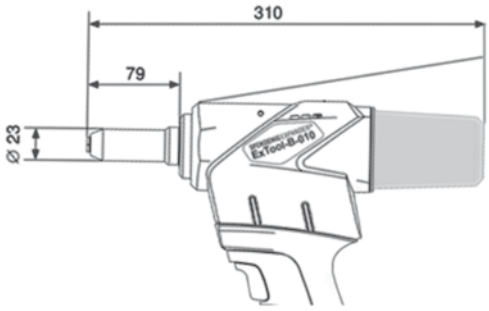
Type	EXTOOL-050
Series	LK
Order number	300179728
Weight	3.4 kg
Pull force at 7 bar	34 kN
Working stroke	13 mm
Air supply pressure (min. - max.)	5-7 bar
Air consumption at 5-6 bar	3.5 l
Noise level	< 75 dB(A)
Cycle time	2.0 s
Nosepiece (not included) Expander LK Ø 18.0	300179935
Nosepiece (not included) Expander LK Ø 20.0	300179938
Jaws Expander LK Ø 18.0 - 20.0	300179934
Jaws case Expander LK Ø 18.0 - 20.0	300179921
Jaws pusher Expander LK Ø 18.0 - 20.0	300179922

Without nosepiece

EXTOOL-B-010 Setting Tool

SFC KOENIG

Battery Tool for Series LK / SK with Mandrel Collection Device



TECHNICAL DATA

Type	EXTOOL-B-010
Series	LK / SK
Order number	300179894
Weight	1.65 kg (without battery)
Pull force	24 kN
Working stroke	30 mm
Weight battery	0.35 kg
Noise level	78.8 dB
Nominal voltage	20 V
Capacity	Li-Ion 2.0 Ah

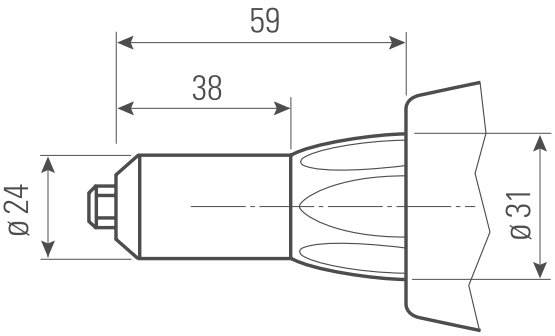
Without nosepieces and equipment kit

Type	Equipment Kit	Nosepieces
Series	LK / SK	LK / SK
Equipment Ø 4.0 – 6.0 (nosepiece not included)	300179925	
Nosepiece Expander LK and SK Ø 4.0		300161899
Nosepiece Expander LK and SK Ø 5.0		300161901
Nosepiece Expander LK and SK Ø 6.0		300161902
Equipment Ø 7.0 – 10.0 (nosepiece not included)	300179926	0.35 kg
Nosepiece Expander LK and SK Ø 7.0		300161911
Nosepiece Expander LK and SK Ø 8.0		300161912
Nosepiece Expander LK and SK Ø 9.0		300161913
Nosepiece Expander LK and SK Ø 10.0		300161914
Equipment Ø 12.0 – 16.0 (nosepiece not included)	300179927 (LK only)	
Nosepiece Expander LK Ø 12.0		300161931 (LK only)
Nosepiece Expander LK Ø 14.0		300161932 (LK only)
Nosepiece Expander LK Ø 16.0		300161933 (LK only)

Nosepieces and Equipment Kit are required and must be purchased separately.

KW-008 Setting Tool

Mechanical Hand Lever Tool for Series LK / SK



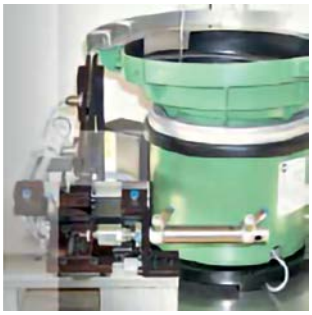
TECHNICAL DATA

Type	KW-008	KW-008
Series	LK	SK
Order number	300159301	300159301
Weight	1.95 kg	1.95 kg
Length	515 mm	515 mm
Nosepiece Expander Ø 4.0	DPM400-B10	DPM400-C10
Nosepiece Expander Ø 5.0	DPM400-D10	DPM400-D10
Nosepiece Expander Ø 6.0	DPM400-E10	DPM400-E10
Jaws Ø 4.0 - 6.0	PRG 540-46E	PRG 540-46E

Hand lever tool with equipment for LK and SK Ø 4 – 6mm

Systems and Automation Solutions

At SFC KOENIG, a complete sealing and flow control solution means the right products are combined with the right assembly and installation processes. By helping customers integrate our parts into their operations we are able to improve efficiency, improve consistency and lower total costs. Our team is ready to work with you to develop a complete automation solution designed for your needs.



We support customers throughout the entire process – from planning, design and product selection, through to development and implementation. SFC KOENIG automation equipment, such as presses and hydraulic tools, combined with our process integration services, allows us to deliver a customised total solution for your operation.

In conjunction with our automation partners, SFC KOENIG offers single-head workstations as well as fully-automated assembly equipment. The direction, type and number of assembly heads can all be customised and integrated into your production line. Built-in processing diagnostics control the assembly process for improved product quality.

SFC KOENIG automation solutions help to ensure that products are placed accurately and consistently, eliminating errors and potential risks. Our customised solutions are developed for efficiency and help you reduce assembly time and lower costs. Our high quality assembly systems:

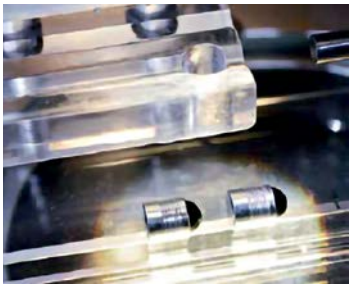
/ are efficient and reliable
/ automatically feed sealing and flow control products
/ easily integrate into assembly lines
/ strictly control the installation process
/ offer process flexibility
/ improve product quality
/ feature a modular design of the placing head
/ are capable of high process speeds
/ feature PLC control and monitoring
/ increase throughput
/ utilise a robust design

Koenig Technical Information

Information About CV Series Available Upon Request

KOENIG EXPANDER® **KOENIG** CHECK VALVE® **KOENIG** RESTRICTOR®

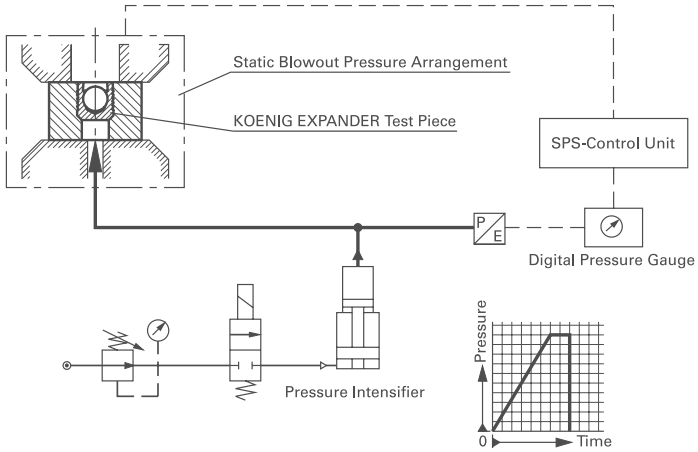
Our technical information section contains reference details related to performance, installation and materials. SFC KOENIG engineers are available to assist you at any time, and can advise on questions and concerns about your individual application. We also offer special orders for customised solutions to meet your individual needs.



Koenig Expander® Test Pressure

TEST PRESSURE Ⓐ

The KOENIG EXPANDER® is statically loaded up to burst pressure. This test is performed at SFC KOENIG for functional testing during the production process. Samples from each production batch are subjected to this functional test.

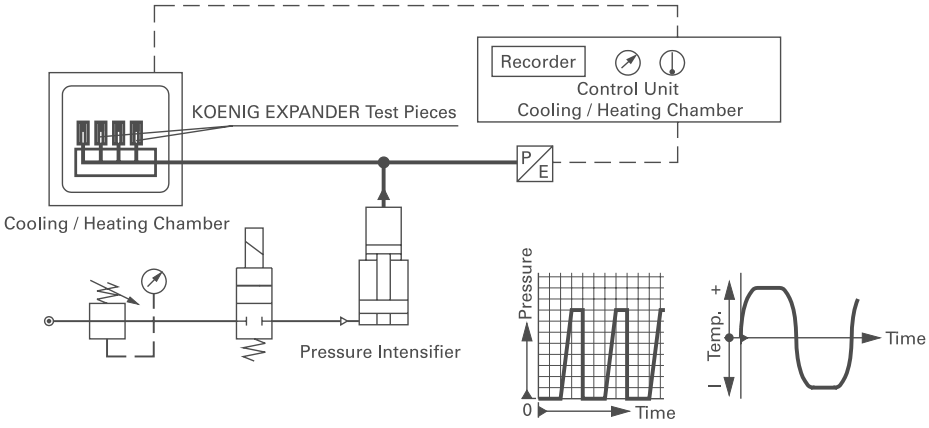


TEST PRESSURE, TEST Ⓑ

The KOENIG EXPANDER® is subjected to a pressure cycling test under varying environmental conditions. The test determines the levels of pressure that can be absorbed by the part by applying intermittent pressure loads and temperature fluctuations to confirm the sealing plug is not squeezed out.

CONDITIONS

- **Temperature:** 2 hrs at +100° C (Series LK/LP at 150° C) / 2 hrs at – 40° C temperature cycle 30 – 45 min.
- **Pressure:** Intermittent, 2 min 0 bar, 3 min test pressure
- **Duration:** 168 hrs (long-term test)
- **Bore:** Tolerance, roundness and roughness in accordance with standard sheets, plain surface, edge and wall distance according to standard sheet.



Base Materials / Installation Requirements

Operating pressures listed can be achieved for the following base materials:

	Base Material of the Installation	Tensile Strength Rm [N/mm²]	Elongation A5 [%]	Yield Strength Rp0.2 [N/mm²]	Hardness HB
❶	**High Strength Steel ETG-100 / 44SMn28 AISI 1144**	960 - 1000	6	min. 865	320 avg.
❷	**Case Hardened Steel C15Pb / 1.0403 AISI 10L15**	430 - 730	10	min. 280	200 avg.
❸	**Ductile Cast Iron EN 1563: GJS-600-3 ASTM A536: 80-60-03**	min. 600	3	min. 370	200 - 290
❹	**Ductile Cast Iron (Dura-Bar®) EN 1563: GJS-450-10 ASTM A536: 65-45-12**	450 avg.	12	310 avg.	131 - 217
❺	**Gray Cast Iron EN 1561: GJL-250 ASTM A48: NO.35**	350 avg.	0.3	165 - 228	160 - 250
❻	**Aluminum-Alloy AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6***	min. 450	8	min. 310	120 avg.
❼	**Aluminum-Alloy AlMgSiPb / EN AW-6012-T6 AA: 6012-T6**	min. 310	8	min. 260	105 avg.
❽	**Cast Aluminum-Alloy G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356**	min. 230	2	min. 190	min. 75

**SFC KOENIG's North American Engineering Department utilises 2024-T4/T6 as a test base material.*

/ Equally high working pressures can also be achieved with base materials with similar mechanical properties. However, compliance must be met for the appropriate installation conditions.
/ Applications in cast aluminum, magnesium alloys, nonferrous metals and plastics require special consideration and can be developed upon request.
/ Applications in base materials with high hardness and hardened materials, require special consideration and can be developed upon request.
/ Applications in surface coated materials (zinc plated, anodised ...) require special consideration and can be developed upon request.
/ For factors affecting pressure performance please see:
– Anchoring Principle
– Surface Finish: Requirements
– Design Guidelines

SAFETY MARGIN

The safety margin includes uncontrollable factors. Dynamic loads at nominal pressure, with 106 load cycles and a frequency of 3 – 4 Hz have shown that the subsequently measured bursting pressures, are reduced according to Test Ⓐ by 20 % as well as Test Ⓑ.

Pressure Performance

Series MB / CV

Series MB 600 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10	1400 bar / 20300 psi 450 bar / 6500 psi					1200 bar / 17400 psi 380 bar / 5500 psi	
Ø 12 – 14	1000 bar / 14500 psi 350 bar / 5100 psi					900 bar / 13000 psi 280 bar / 4100 psi	
Hole Tolerance	0 / +0.1 mm						
Hole Roughness	R_z 10 – 30 µm				Anchorage in Base Metal		

Series MB 600 Inch	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 0.093 – 0.281	1400 bar / 20300 psi 450 bar / 6500 psi					1200 bar / 17400 psi 380 bar / 5500 psi	
Hole Tolerance	Ø 0.093 0 / +0.002 Inch from Ø 0.125 0 / +0.004 Inch						
Hole Roughness	R_z 10 – 30 µm				Anchorage in Base Metal		

Series MB 700 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10	1400 bar / 20300 psi 450 bar / 6500 psi					1200 bar / 17400 psi 380 bar / 5500 psi	
Ø 12 – 22	1150 bar / 16700 psi 350 bar / 5100 psi					900 bar / 13000 psi 280 bar / 4100 psi	
Hole Tolerance	0 / +0.1 mm						
Hole Roughness	R_z 10 – 30 µm				Anchorage in Base Metal		

Series MB 850 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10	1100 bar / 16000 psi 350 bar / 5100 psi					1000 bar / 14500 psi 320 bar / 4600 psi	
Ø 12 – 22	900 bar / 13000 psi 280 bar / 4100 psi					800 bar / 11600 psi 250 bar / 3600 psi	
Hole Tolerance	0 / +0.1 mm						
Hole Roughness	R_z 10 – 30 µm				R_z 10 – 30 µm	Anchorage in Base Metal	

Series CV 173 mm	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 3 – 10				650 bar / 9400 psi 210 bar / 3000 psi	
Ø 12				300 bar / 4300 psi 100 bar / 1500 psi	
Hole Tolerance	0 / +0.1 mm				
Hole Roughness	R_z 10 – 30 µm			Anchorage in Base Metal	

Series CV 588 mm	Base Material of the Installation				
	❶ ETG-100 / 44SMn28 AISI 1144	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 9	1000 bar / 14500 psi 350 bar / 5000 psi				
Ø 10	860 bar / 12500 psi 280 bar / 4000 psi				
Hole Tolerance	0 / +0.1 mm				
Hole Roughness	R_z 10 – 30 µm			Anchorage in Base Metal	

Proof Pressure Test Ⓑ **Max. Allowable Working Pressure = Nominal Pressure**

See Anchorage Principles related to the base materials on page 413.

Pressure Performance

Series SK / LP / LK / RE

Series SK mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 10	1400 bar / 20300 psi 500 bar / 7200 psi					1400 bar / 20300 psi 450 bar / 6500 psi	
Ø 12	1600 bar / 23200 psi 400 bar / 5800 psi						
Hole Tolerance	0 / +0.12 mm						
Hole Roughness	R_z 10 – 30 µm				Anchorage in Base Metal		

If SK plugs are used to keep channels separated, allowable working pressure on the insertion side is reduced by 50%.

Series LP mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 12	180 bar / 2600 psi 60 bar / 850 psi						
Hole Tolerance	According to Data Sheet						
Hole Roughness	R_z 10 – 30 µm				Anchorage in Base Metal		

❶❷❸❺❻ Temperature range for proof pressure test Ⓑ: – 40 °C to + 150 °C ❼❽ Temperature range for proof pressure test Ⓑ: – 40 °C to + 100 °C

Series LK 600 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 10	180 bar / 2600 psi 60 bar / 850 psi						
Hole Tolerance	0 / +0.12 mm						
Hole Roughness	R_z 10 – 30 µm					Anchorage in Base Metal	

❶❷❸❺ Temperature range for proof pressure test Ⓑ: – 40 °C to + 150 °C ❻❼❽ Temperature range for proof pressure test Ⓑ: – 40 °C to + 100 °C

Series LK 950 mm	Base Material of the Installation						
	❶ ETG-100 / 44SMn28 AISI 1144	❷ C15Pb / 1.0403 ~ SAE 1015 (10L15)	❸ EN 1563: GJS-600-3 ASTM A536: 80-60-03	❺ EN 1561: GJL-250 ASTM A48: NO.35	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❼ AlMgSiPb / EN AW-6012-T6 AA: 6012-T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4 – 20	180 bar / 2600 psi 60 bar / 850 psi						
Hole Tolerance	+0.05 / +0.15	0 / +0.12 mm					
Hole Roughness	R_z 10 – 30 µm					R_z 10 – 30 µm	Anchorage in Base Metal

❶❷❸❺ Temperature range for proof pressure test Ⓑ: – 40 °C to + 150 °C ❻❼❽ Temperature range for proof pressure test Ⓑ: – 40 °C to + 100 °C

KOENIG EXPANDER® sealing plugs series LK are not suitable for pressure load applied on the insertion side of the plug. For special release contact SFC KOENIG.

Series RE mm	Base Material of the Installation			
	❶ ETG-100 / 44SMn28 AISI 1144	❹ EN 1563: GJS-450-10 ASTM A536: 65-45-12	❻ AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6	❽ G-AlSi7Mg / EN-AC-42100 ASTM/UNS: A356
Ø 4	120 bar / 1740 psi			100 bar / 1450 psi
Ø 5	180 bar / 2610 psi			150 bar / 2175 psi
Ø 6	210 bar / 3045 psi			150 bar / 2175 psi
Ø 7 – 8	210 bar / 3045 psi			180 bar / 2610 psi
Ø 9 – 10	Please Contact Us for Details			

Proof Pressure Test Ⓑ **Max. Allowable Working Pressure = Nominal Pressure**

Base Material Harder than Expander: To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required. **Roughness R_z = 10 – 30 µm.**

Base Material Softer than Expander: Anchorage to the bore of the base material occurs automatically due to the serrations on the sleeve of the KOENIG EXPANDER®.

Transition Zone: To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required. **Roughness R_z = 10 to 30 µm.**

See Anchorage Principles related to the base materials on opposite page.

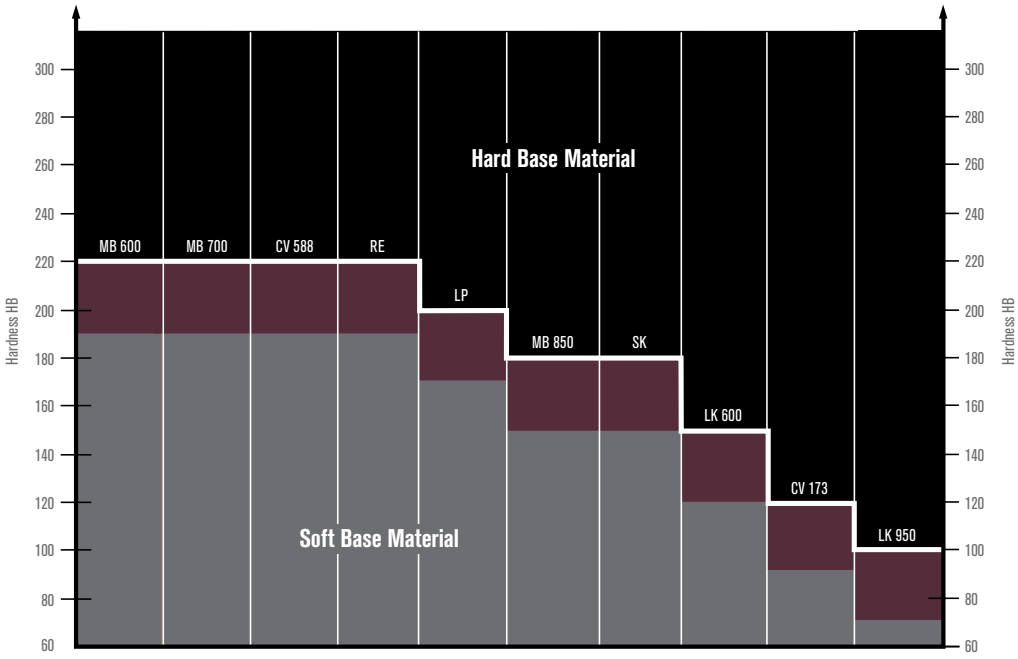
Anchorage Principle

The required bore roughness is directly related to the hardness and the mechanical characteristics of the base material. Depending on the combination of sealing plug and base material, anchorage takes place either by the groove profile of the expander sleeve biting into the base material or on anchorage to the surface roughness of the bore.

Note: When selecting a KOENIG EXPANDER® the bore roughness must always be adjusted according to the hardness of the base material.

Anchorage between sleeve and base material is achieved when the sleeve is a minimum of HB = 30 greater than the base material. If the hardness difference is less, hole roughness of 10 to 30 µm is needed to achieve indicated working pressures.

ANCHORAGE PRINCIPLE RELATED TO THE BASE MATERIAL

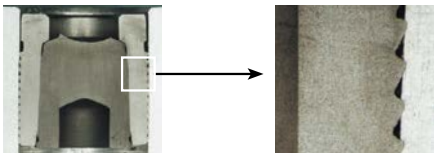


Base Material Harder than Expander: To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required. **Roughness R_Z = 10 – 30 µm.**

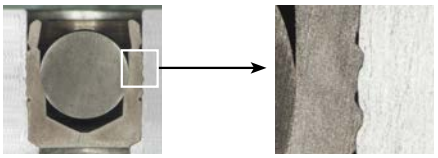
Base Material Softer than Expander: Anchorage to the bore of the base material occurs automatically due to the serrations on the sleeve of the KOENIG EXPANDER®.

Transition Zone: To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required. **Roughness R_Z = 10 to 30 µm.**

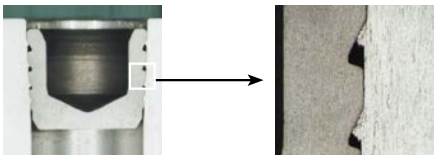
Anchorage Principle



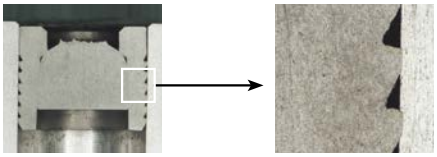
Anchorage due to plug sleeve serrations
KOENIG EXPANDER® **Series SK**
In aluminum-alloy HB = 90



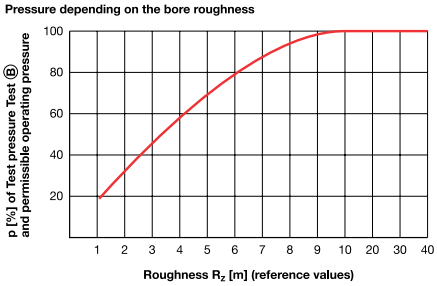
Anchorage due to plug sleeve serrations
KOENIG EXPANDER® **Series MB 850**
In aluminum-alloy HB = 90



Anchorage due to plug sleeve serrations
KOENIG EXPANDER® **Series LP**
In aluminum-alloy HB = 90

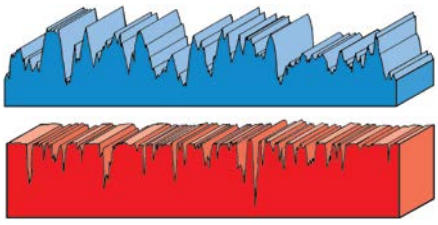


Sufficient anchorage due to plug sleeve serrations
KOENIG EXPANDER® **Series LK 950**
In aluminum-alloy HB = 90



BORE ROUGHNESS REQUIREMENTS

When installing KOENIG EXPANDER® plugs in hard base material positive anchoring is not possible. To attain suitable working pressures and anchorage, it is necessary to have a bore roughness of R_Z = 10–30 µm. At a roughness greater than R_Z = 30 µm leakage might occur.



ROUGHNESS PROFILE

Required Roughness Profile

The ideal bore roughness for anchorage is attained by drilling with a twist drill or a core drill.

Undesirable Roughness Profile

By reaming, a one-sided, smooth roughness profile is created. This is not desirable.

Installation Instructions for MB Series

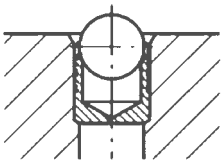


Fig. 1

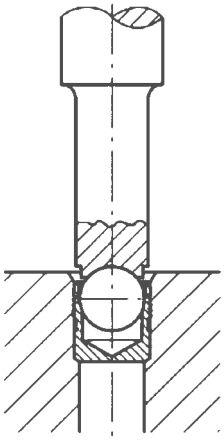


Fig. 2

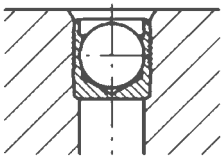


Fig. 3

DRILLED HOLE

/ The drilled hole must be within the tolerances shown on the preceding dimensional sheets.
/ The counterbored hole (d2) must be properly sized for the through hole (d3) according to the dimensional sheets.
/ Holes must be round within 0.05 mm.
/ With hard materials the bore roughness should be from R_Z = 10–30 µm for best results.
/ Longitudinal rifles and spiral grooves should be avoided. These influence the sealing effectiveness.
/ The bore must be free of oil, grease and chips.

SETTING PROCEDURE

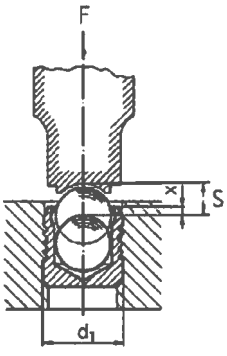
/ With the ball facing out the KOENIG EXPANDER® is inserted in the counterbored hole. The top sleeve should not be above the surface of the base material (Fig. 1).
/ With only a slight or no counterbore, the base of the sleeve must be adequately supported during installation.
/ The ball can now be pressed in until the top of the ball is below the edge of the sleeve (Fig. 2 and 3). Corresponding approximate values for stroke S as well as the dimensions X are from the table below.

Note:

/ Use the proper size setting tool for the KOENIG EXPANDER® according to the data sheet.
/ Spray cleaning with air drying is the only way to clean/degrease plugs before installation. Do not dip and vacuum dry the plugs.

PRESS

Small quantities or single parts can be installed with a hammer and a setting tool. Installation can also be done with an arbor press. It is preferred to limit stroke travel when using a press because insertion force is difficult to control. KOENIG EXPANDER® plugs are also ideal for automated installation because they are problem free.



INSTALLATION CHART

Series MB 600 / MB 700 / MB 850														
d1 (mm)		3	4	5	6	7	8	9	10	12	14	16	18	20	22
s (mm)	Stroke (approx. values)	1.2	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.5	6.35	7.0	8.0	9.0	10.0
x (mm) ±0.2	Position of Top of Ball Relative to Top of Sleeve	0.4	0.2	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.6	0.6	0.8	0.8

Series MB 600 Inch-Version							
d1 (inch)		.093	.125	.156	.187	.218	.250	.281
s (in)	Stroke (approx. values)	.031	.047	.059	.079	.094	.109	.118
x (in) 0/-0.012	Position of Top of Ball Relative to Top of Sleeve	Flush to .012 Below the Sleeve						

Installation Instructions for MB Series

PLUG REMOVAL

With KOENIG EXPANDER® MB Series removal of the plug is possible. The plug can be drilled out with a carbide tipped drill or with a high speed steel drill.

Plug Removal Drill Bit Recommendation		
MB 600-030 to 140	Ball HB ~250	High Speed Steel Drill
MB 600-093 A	Ball HRC ~55	Carbide Tipped Drill
MB 600-125 A to 281 A	Ball HB ~250	High Speed Steel Drill
MB 700-030 to 220	Ball HRC ~45	Carbide Tipped Drill
MB 850-030 to 220	Ball HRC ~45	Carbide Tipped Drill

PROCEDURE:

/ For KOENIG EXPANDER® smaller than 6mm or .250 inches in diameter: Drill out, in one process, to the **next larger diameter** according to the data sheet.
/ For KOENIG EXPANDER® models larger than 6mm or .250 inches in diameter: Drill out in several steps with last step to the **next larger diameter** according to the data sheet.
/ Clear chips, remnants of the sleeve, and oil and grease from the bore.
/ Inspect bore to confirm that it meets all requirements.
/ Install a new KOENIG EXPANDER®.

Note:
After plug removal always use the next larger size plug.

Installation Instructions for SK Series

DRILLED HOLE

/ The drilled hole must be within the tolerances shown on the preceding data sheets.
/ Holes must be round within 0.05 mm.
/ With hard materials the bore roughness should be from $R_Z = 10–30$ µm for best results.
/ Longitudinal rifles and spiral grooves should be avoided. These influence the sealing effectiveness.
/ The bore must be free of oil, grease and chips.

SETTING PROCEDURE

/ Insert the plug in the tool, making sure that the sleeve is against the nosepiece (Fig. 1).
/ After inserting the plug into the hole (ensuring the tool is flush to the work surface) activate the tool to expand the plug.
/ The mandrel will break apart when the proper tension has been reached (Fig. 2 and 3).

Note:
/ The assembly of KOENIG EXPANDER® plugs should only be done in a **clean working area**.
/ The sleeve and mandrel of the **plug should not be cleaned, lubricated or have sealant (compound) applied**.

TOOLS

For trouble free installation of KOENIG EXPANDER® plugs use the tools and appropriate components according to the data sheet.

PLUG REMOVAL

With KOENIG EXPANDER® SK Series plug removal is possible.

PROCEDURE

/ Drive the mandrel from the sleeve with a punch.
/ Drill out the sleeve and remove the mandrel.
/ Bore the hole to the **next larger Expander diameter** per the data sheet.
/ Clear chips, remnants of the sleeve, and oil and grease from the bore.
/ Inspect bore to confirm that it meets all requirements.
/ Install a new KOENIG EXPANDER®.

Note: After plug removal always install the next larger size plug.

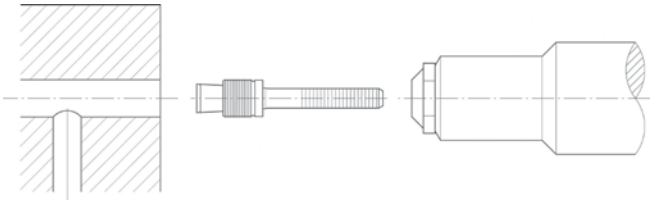


Fig.1

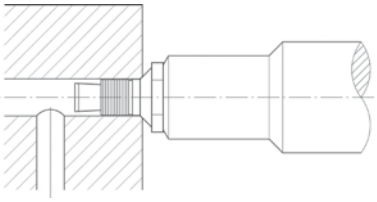


Fig.2

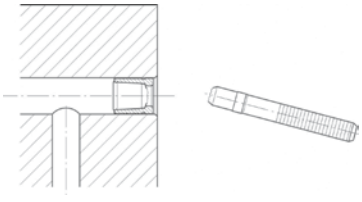


Fig.3

Installation Instructions for LK Series

DRILLED HOLE

1. The drilled hole must be within the tolerance shown on the dimensional sheets. In base materials with high hardness or hardened materials:
   - < 280HB the bore tolerance should be 0 / + 0.12
   - ≥ 280HB the bore tolerance should be +0.05 / + 0.15
2. Holes must be round within 0.05 mm.
3. With hard materials the bore roughness should be from R_Z = 10–30 µm for best results.
4. Longitudinal rifles and spiral grooves should be avoided. These influence the sealing effectiveness.
5. The bore must be free of oil, grease and chips.

SETTING PROCEDURE

/ Insert the plug in the tool, ensuring that the sleeve is against the nosepiece (Fig. 1).
/ After inserting the plug into the hole activate the tool to expand the plug.
/ The mandrel will break apart when the proper tension has been reached (Fig. 2 and 3).

Note:
/ The assembly of KOENIG EXPANDER® plugs should only be done in a **clean working area.**
/ The sleeve and mandrel of **the plug should not be cleaned, lubricated or have sealant (compound) applied.**

TOOLS

For trouble free installation of KOENIG EXPANDER® plugs use the tools and appropriate components according to the data sheet.

PLUG REMOVAL

With KOENIG EXPANDER® plugs LK Series plug removal is possible.

PROCEDURE

/ Drive the mandrel from the sleeve with a punch.
/ Drill out the sleeve and remove the mandrel.
/ Bore the hole to the **next larger Expander diameter** per the data sheet.
/ Clear chips, remnants of the sleeve and oil and grease from the bore.
/ Inspect bore to confirm that it meets all requirements.
/ Install a new KOENIG EXPANDER®.

Note: After plug removal always install the next larger size plug.

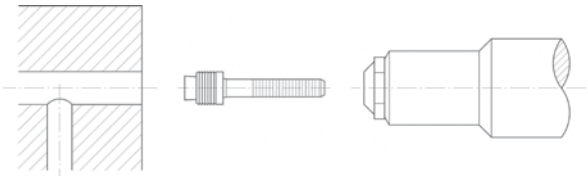


Fig.1

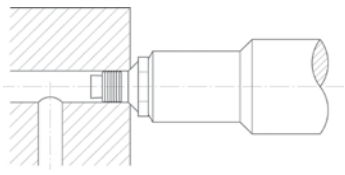


Fig.2

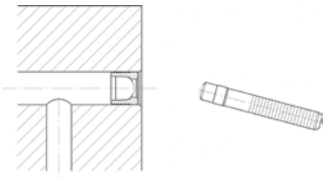


Fig.3

Installation Instructions for LP Series

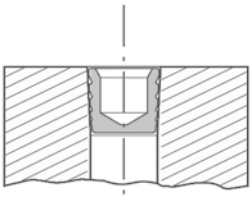


Fig. 1

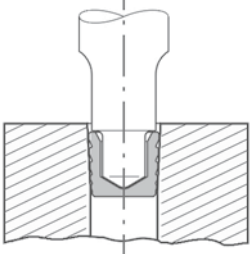


Fig. 2

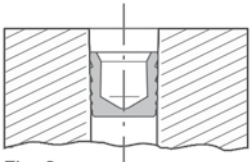


Fig. 3

DRILLED HOLE

/ The drilled hole must be within the tolerances shown on the dimensional sheets.
/ A 1:12 cone rate must be maintained as per the specification sheet.
/ Holes must be round within 0.05 mm.
/ With hard materials the bore roughness should be from R_Z = 10–30 µm for best results.
/ Longitudinal rifles and spiral grooves should be avoided. These influence the sealing effectiveness.
/ The bore must be free of oil, grease and chips.

SETTING PROCEDURE

/ With the setting hole facing out, the LP-plug is inserted in the cone bore. The top sleeve should not be above the surface of the base material (Fig. 1).
/ The LP-plug can now be pressed in with the setting tool. Corresponding approximate values for stroke S are from the table below (Fig. 2).
/ Installed LP-plug (Fig. 3).

Note:
/ Use the proper size setting tool for the KOENIG EXPANDER® according to the data sheet.
/ A higher setting force might occur if the LP plugs are washed before installation.

PRESS

/ It is preferred to limit travel when using a press because insertion force is difficult to control.
/ Recommended setting speed is 5 mm/sec.
/ The KOENIG EXPANDER® ensures an optimum orientation, it works perfectly with automatic processing.

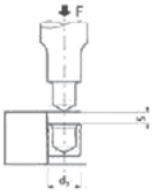
PLUG REMOVAL

With KOENIG EXPANDER® LP Series plug removal is possible. The plug can be drilled out with a high speed steel drill.

PROCEDURE

/ Drill out, in one process, to the next larger diameter, nominal diameter d4 according to the data sheet.
/ Drill the taper hole with a reamer up to diameter d3 according to the data sheet.
/ Clear chips, remnants of the sleeve, and oil and grease from the bore.
/ Install a new KOENIG EXPANDER®.

Note: After plug removal always install the next larger size plug.



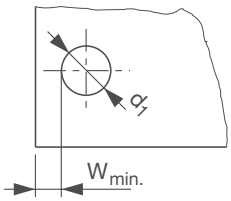
INSTALLATION CHART

Series LP 900								
Diameter	4	5	6	7	8	9	10	12
Stroke S (mm) +/- 0.25	1.0	1.3	1.3	1.5	1.8	1.8	2.0	2.0

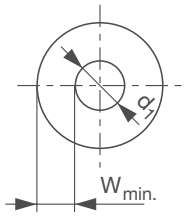
In steel, gray cast nodulized cast iron, aluminum wrought alloy, aluminum-cast material.

Design Guidelines

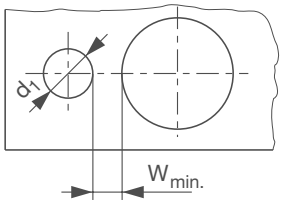
Distance to External Wall



Distance to Exterior Wall



Wall Thickness Between Bores



WALL THICKNESS / DISTANCE FROM EDGE

As the radial expansion of the KOENIG EXPANDER® sleeve occurs, the base material in which it will be anchored plastically deforms. The resultant strength, as well as the hydraulic pressure and temperature service conditions depending on the expander type and characteristics of the base material, require minimum wall thickness, or distance from edge.

The guideline values for minimum wall thickness and distance from edge ($W_{min.}$) express these influencing factors. At these minimum values, only slight deformation on the exterior profile of the base material of less than 20 µm is likely. This does not affect the function of the KOENIG EXPANDER®. Below the guideline values ($W_{min.}$) the possibility of overloading the base material exists, which can adversely influence the function of the KOENIG EXPANDER®. In such cases tests must be conducted.

Guideline values $W_{min.}$ for wall thickness and distance from edge

KOENIG EXPANDER® diameters Series MB / SK and LP

$d1 \geq 4$ mm: $W_{min.} = f_{min.} \times d1$

$d1 < 4$ mm: $W_{min.} = f_{min.} \times d1 + 0.5$ mm

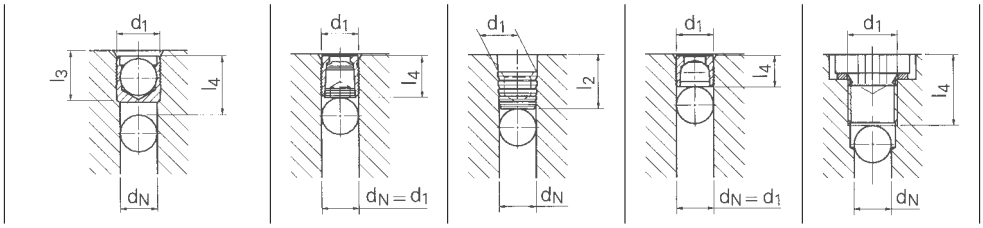
KOENIG EXPANDER® diameters Series LK / RE

$d1 \geq 5$ mm: $W_{min.} = f_{min.} \times d1$

$d1 = 4$ mm: $W_{min.} = f_{min.} \times d1 + 0.5$ mm

		❶	❷	❸	❺	❻	❼	❽
Base Material	Description	ETG100	C15Pb	EN-GJS-600-3	EN-GJL-250	AlCu4Mg1	AlMgSiPb	G-AlSi7Mg
	Avg. Tensile Strength RM [N/mm²]	1000	560	650	300	480	340	260
	Minimum Elongation A5 [%]	6	10	3	0.3	8	8	2
	Avg. Ultimate Strength Rp 0.2 [N/mm²]	900	300	425	200	380	290	220
KOENIG EXPANDER® Series		Factor $f_{min.}$						
MB 600		0.6	0.8	0.8	1.0	0.8	1.0	1.0
MB 600, Inch-Version		0.6	0.8	0.8	1.0	0.8	1.0	1.0
MB 700		0.6	0.8	0.8	1.0	0.8	1.0	1.0
MB 850		0.5	0.6	0.6	1.0	0.6	1.0	1.0
CV 173		0.5	0.6	0.7	0.8	0.7	0.8	0.8
CV 588		0.6	0.8	0.8	1.0	0.8	1.0	1.0
SK		0.5	0.6	0.6	1.0	0.8	1.0	1.0
LP		0.3	0.3	0.3	0.5	0.4	0.5	0.5
LK 600		0.4	0.5	0.5	0.8	0.7	0.7	0.7
LK 950		0.3	0.3	0.4	0.6	0.5	0.5	0.5
RE		0.3	0.3	0.5	0.6	0.5	0.5	0.5

Required Installation Lengths

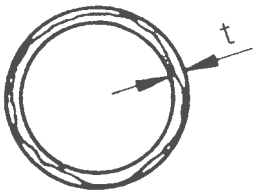


d_N	Series MB			Series SK		Series LP		Series LK		Threaded Plugs DIN 908	
	d_1	l_3 min.	l_4 min.	d_1	l_4 max.	d_1	l_2 min.	d_1	l_4 max.	d_1	l_4 max.
2.0	3.0	3.4	5.0								
3.0	4.0	3.8	5.5								
4.0	5.0	5.3	7.0	4.0	6.5	4.40	7.0	4.0	4.0		
5.0	6.0	6.3	8.5	5.0	7.5	5.40	8.0	5.0	4.8	M8x1.5	11.5
6.0	7.0	7.3	9.5	6.0	8.0	6.40	8.5	6.0	5.3	M8x1.5	11.5
7.0	8.0	8.3	11.0	7.0	9.0	7.40	8.5	7.0	5.8	M10x1.5	12.0
8.0	9.0	9.8	12.5	8.0	10.5	8.45	9.5	8.0	6.8	M10x1.5	12.0
9.0	10.0	10.8	13.5	9.0	11.0	9.60	10.0	9.0	6.8	M12x1.5	16.0
10.0	12.0	12.8	16.0	10.0	12.5	10.65	11.0	10.0	6.8	M12x1.5	16.0
12.0	14.0	14.5	18.0	12.0	16.5	12.75	12.0	12.0	7.8	M14x1.5	16.0
14.0	16.0	16.5	20.0					14.0	8.7	M16x1.5	16.5
16.0	18.0	18.5	22.5					16.0	11.5	M18x1.5	17.5
18.0	20.0	21.5	25.5					18.0	13.0	M20x1.5	19.5
20.0	22.0	24.5	28.5					20.0	13.0	M22x1.5	19.5

d_N = Given nominal bore / system bore size

***Installation Lengths Series MB**
The required installation length (l4) min. for MB plugs is for base materials with hardness greater than HB = 90.
For softer materials, deeper installation is required.

Design Guidelines



ROUNDNESS TOLERANCE

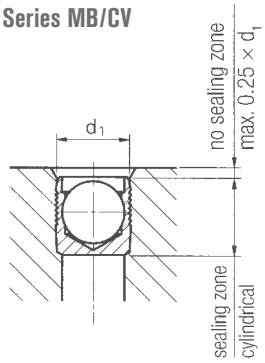
To ensure reliable functioning of the KOENIG EXPANDER® with regard to pressure performance and to ensure leak tight sealing, a **roundness tolerance of t = 0.05 mm** must be held.

By using a double lipped twist drill, the called out hole and roundness tolerances are reached. Better tolerances, particularly for larger diameter holes, can be held by using a **triple lipped** twist drill.

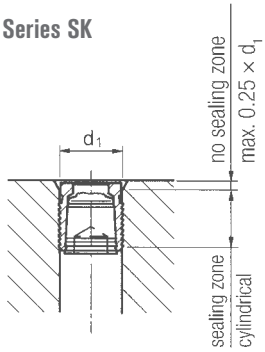
CONICITY OF THE BORE

Within the effective sealing area of the KOENIG EXPANDER®, the bore must be according to the dimensional sheets. The bore lead in can be chamfered up to a depth of **0.25 x d_1 (LK: 0.15 x d_1)** because this area has no significant effect on the sealing function.

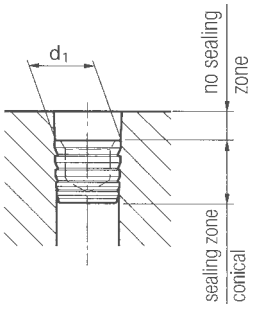
Series MB/CV



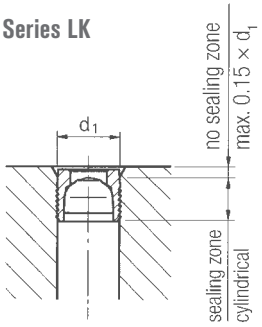
Series SK



Series LP



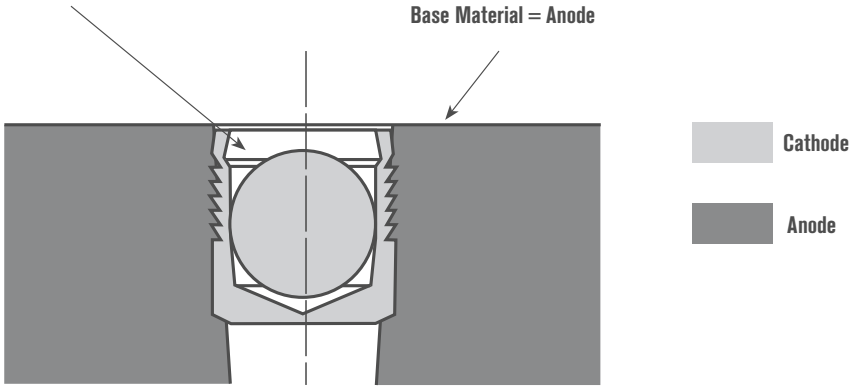
Series LK



Galvanic Corrosion

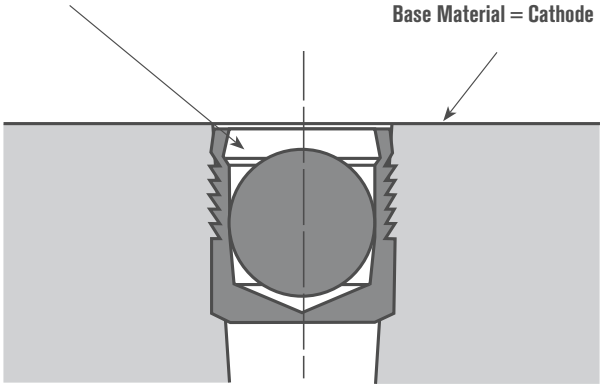
In choosing a KOENIG EXPANDER® you must consider that the material of the sealing plug and the material of the production piece can show different electrical potentials. In the presence of an electrolyte (e.g. 5% water-NaCl solution), this potential difference causes electrochemical attack on the least noble of the metals in contact – galvanic corrosion. In this case, either the base material or its surface protection will become the anode and will be transferred to the pure metal of the cathode. The corrosion speed or the current density will be determined by the relative surface area or volume of the anode and cathode as illustrated below.

KOENIG EXPANDER® = Cathode



Large Anode Area –> Low Current Density at the Anode –> Slow Corrosion

KOENIG EXPANDER® = Anode



Small Anode Area –> High Current Density at the Anode –> Fast Corrosion

Galvanic Corrosion

EFFECT OF GALVANIC CORROSION

The following table shows the expected galvanic corrosion behavior of KOENIG EXPANDER® plugs in common base materials allowing for the relative surface areas of both metals, which influences the speed of corrosion.

Installation Material		Series										
		MB 600	MB 700	MB 850	CV 173	CV 588	SK	LP	LK 600	LK 950	BF/BR	RE
Steel, Carbon/Low Alloy, Plain												
Steel, Carbon/Low, Zn Plated, Chromate				■	■							
Steel, Carbon/Low Alloy, Phosphatized												
Nitrided or Case Hardening Steel		Behavior Depends on the Method Used										
Stainless Steel, X8CrNiS18-9, 1.4305, ANSI 303		■	■	■	■	■	■		■	■	■	■
Stainlesss Steel, X12CrS13, 1.4005, ANSI 416		■	■	■	■	■	■		■	■	■	■
Cast Iron, EN 1561, Plain					■							
Cast Iron, EN 1561, Zn Plated, Chromate				■	■							
Cast Iron, EN 1561, Phosphatized					■							
Ductile Cast Iron, EN 1563, Plain					■							
Ductile Cast Iron, EN 1563, Zn Plated, Chromate				■	■							
Ductile Cast Iron, EN 1563, Phosphatized					■							
AlMg1SiCu	EN AW-6061											
AlMgSiPb	EN AW-6062											
AlCu4Mg1	EN AW-2024				■							
AlZnMgCu1,5	EN AW-7075											
G-AlSi7Mg	A-Norm 356											
G-AlSi9Mg												
G-AlSi10Mg												

■ = Accelerated ■ = Not Accelerated ■ = Slightly Accelerated

Key to the galvanic corrosion behavior of KOENIG EXPANDER® plugs in the presence of an electrolytic medium installed in base materials per the above table.

Suggestions to Prevent Galvanic Corrosion:

/ Choose materials with no or low potential difference.
/ Use corrosion reducing designs, i.e. if possible prevent the accumulation of fluids on the outer surface of the workpiece.
/ By using suitable surface coatings, corrosion attack can be considerably reduced.

Salt spray testing per DIN EN ISO 9227 is available upon request.

Installation Instructions for Koenig Check Valve®

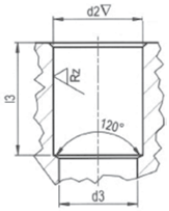


Fig. 1

Before Installation

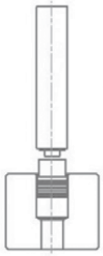


Fig. 2

After Installation

Fig. 3

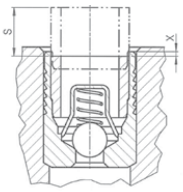


Fig. 4 (Reverse Flow)

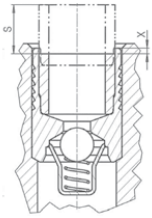


Fig. 5 (Forward Flow)

DRILLED HOLE

/ The drilled hole (Fig. 1) must be within the tolerances shown on the preceding dimensional sheets.
/ The counter-bored hole (d2) must be properly sized for the through hole (d3) according to the dimensional sheets.
/ Hole must be round within 0.05 mm.
/ With hard materials (HB > 190) the bore roughness should be from R_z = 10 – 30 µm for best results.
/ Longitudinal rifles and spiral grooves should be avoided.
/ The bore must be free of oil, grease and chips.
/ Additional reaming operation on the hole is not required.

SETTING PROCEDURE

/ With the pin facing out, the KOENIG CHECK VALVE® is inserted in the counterbored hole (Fig. 2). The top surface of the sleeve should not be above the top surface of the base material.
/ With only a slight or no counter-bore, the base of the sleeve must be adequately supported during installation.
/ The pin can now be pressed in until the top of the pin is flush with the top surface of the sleeve. Corresponding approximate values for stroke S, as well as the dimension X can be referred from the dimensional sheets (Fig. 3, 4 and 5).

Note:

/ Use the proper size setting tool for the KOENIG CHECK VALVE® according to the data sheet.
/ Clean/degrease the KOENIG CHECK VALVE® before installation; only spray cleaning with air drying is allowed (no dipping or vacuum drying).
/ Sealants or locking compounds should not be applied on the KOENIG CHECK VALVE®.

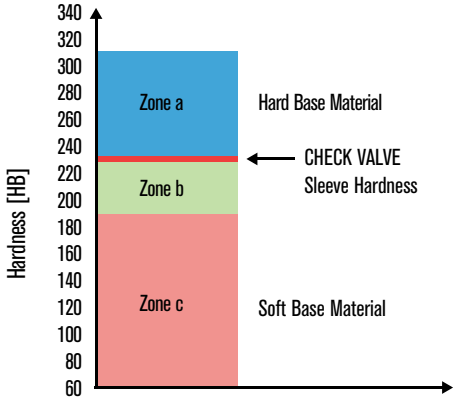
PRESS

Small quantities or single parts can be installed with a hammer and setting tool. Installation can also be done with an arbor press. It is preferred to limit stroke travel when using a press because insertion force is difficult to control. The KOENIG CHECK VALVE® is also ideal for automated installation.

Anchorage Principles for Koenig Check Valve®

The required bore roughness is directly related to the hardness and the mechanical characteristics of the base material. Depending on the combination of the KOENIG CHECK VALVE® and the base material, anchorage takes place either by the groove profile of the KOENIG CHECK VALVE® sleeve biting into the base material or on anchorage to the surface roughness of the bore.

Note:
When selecting a KOENIG CHECK VALVE®, the bore roughness must always be adjusted according to the hardness of the base material. Anchorage between sleeve and base material is achieved when the sleeve is a minimum of HB = 30 greater than the base material. If the hardness difference is less, hole roughness of 10 to 30 µm is needed to achieve good anchorage for the rated working pressure differential values.



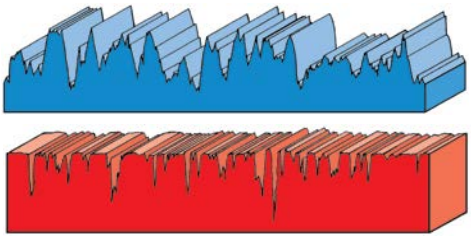
Zone a – Hard Base Material (HB > 220)
To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required.
Roughness R_Z = 10 – 30 µm.

Zone b – Transition Zone (HB 190 - 220)
To achieve the allowable working pressure, anchorage to the bore roughness of the base material is required.
Roughness R_Z= 10 – 30 µm.

Zone c – Soft Base Material (HB < 190)
Anchorage to the bore of the base material occurs automatically due to the serrations on the sleeve.

REFERENCE

Base Material of the Installation		
Steel	Cast Iron	Aluminum Alloy
R_Z = 10 – 30 µm		R_Z = 4 – 30 µm



ROUGHNESS PROFILE

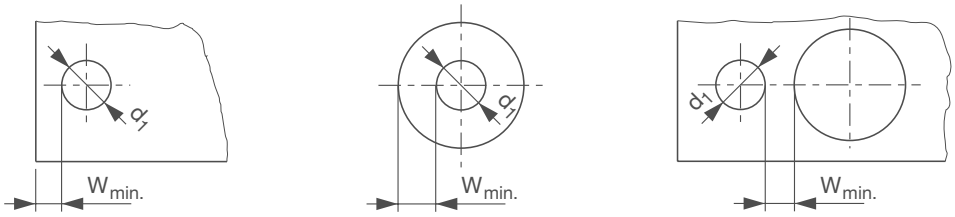
Required Roughness Profile
The ideal bore roughness for anchorage is attained by drilling with a twist drill or a core drill.

Undesirable Roughness Profile
By reaming, a one-sided, smooth roughness profile is created. This is not desirable.

WALL THICKNESS / DISTANCE FROM EDGE

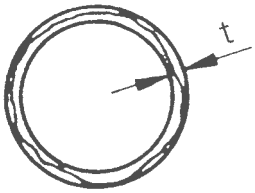
As the radial expansion of the KOENIG CHECK VALVE® sleeve occurs, the base material in which it anchors plastically deforms. The resultant strength, as well as the hydraulic pressure and temperature service conditions depending on the characteristics of the base material, require a minimum wall thickness or distance from edge.

The guideline values for minimum wall thickness and distance from edge ($W_{min.}$) express these influencing factors. At these minimum values, only slight deformation on the exterior profile of the base material of less than 20 µm is likely. This does not affect the function of the KOENIG CHECK VALVE®. Below the guideline values ($W_{min.}$) the possibility of overloading the base material exists, which can adversely influence the function of the KOENIG CHECK VALVE®. In such cases, tests must be conducted.



$W_{min.} = f_{min.} \times d_1$

Base Material of the Installation				
ETG-100 / 44SMn28 AISI 1144	EN 1563: GJS-600-3 ASTM A536: 80-60-03	AISI 303 EN 1.4305 X8CrNiS18-9	EN 1563: GJS-450-10 ASTM A536: 65-45-12	AlCu4Mg1 / EN AW-2024-T3 AA: 2024 T4/T6
Factor, f min				
0.4	0.5	0.5	0.8	0.5



ROUNDNESS TOLERANCE

To ensure reliable functioning of the KOENIG CHECK VALVE® with regard to pressure performance and to ensure leak tight sealing, a roundness tolerance of t = 0.05 mm must be held. By using a double-lipped twist drill, the called out hole and roundness tolerances are reached. Better tolerances, particularly for larger diameter holes, can be held by using a triple-lipped twist drill.

CONICITY OF THE BORE

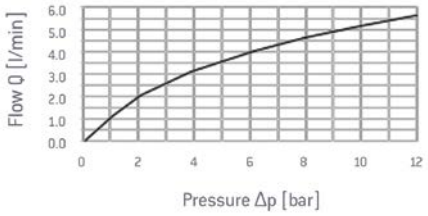
Within the effective anchorage area of the KOENIG CHECK VALVE®, the bore must be in accordance with the dimensional sheets. The bore lead in can be chamfered up to a depth of 0.25 x d_1 (check valve diameter) because this area has no significant effect on the anchorage function.

Technical Information for Koenig Check Valve®

Flow Curves

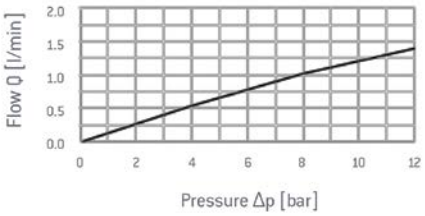
CHECK VALVE FLOW CURVE – UNSCREENED

BFAA055U014; T=50°C; Hydraulic Oil HLP46



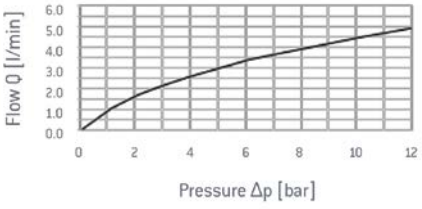
CHECK VALVE FLOW CURVE – SCREENED

BFAA055S014; T=50°C; Hydraulic Oil HLP46



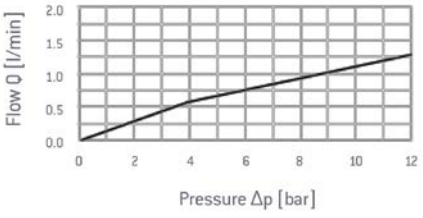
CHECK VALVE FLOW CURVE – UNSCREENED

BRAA055U014; T=50°C; Hydraulic Oil HLP46



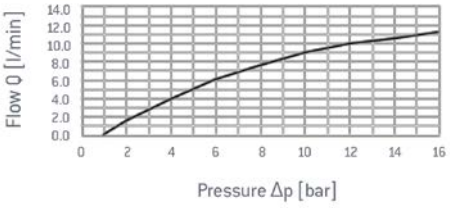
CHECK VALVE FLOW CURVE – SCREENED

BRAA055S014; T=50°C; Hydraulic Oil HLP46



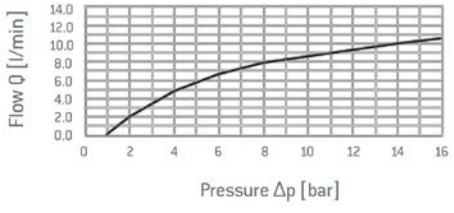
CHECK VALVE FLOW CURVE – UNSCREENED

BF660080024100; T=50°C; Hydraulic Oil HLP46



CHECK VALVE FLOW CURVE – UNSCREENED

BR660080024100; T=50°C; Hydraulic Oil HLP46



Technical Information Koenig Restrictor®

SFC KOENIG provides several restrictor options for different application requirements, and customers can select the restrictor's orifice size. This allows you to have complete design control – CV expansion and threaded restrictors are custom-made to meet your orifice performance requirements. As with any component in your system design, there are many technical factors to consider. This is one method for calculating orifice diameter for the SFC KOENIG restrictor products.

/ This equation was derived by rearranging Bernoulli's Equation and using a Coefficient of Discharge (CD).
/ The Coefficient of Discharge (CD) accounts for pressure losses resulting from factors such as orifice geometry, turbulence near the orifice hole, the length of the orifice hole, and flow dynamics.
/ This equation for calculating the restrictor orifice diameters should be used as reference only. SFC KOENIG recommends that you perform testing in the actual application environment to determine the flow constant.
/ This equation is intended as a guide for fluid applications only; it is not applicable for gas flow applications.

METRIC

To calculate restrictor orifice diameter in mm:

$$d_{orifice} \approx \sqrt{2.144 \times Q \left(\sqrt{\frac{SG}{\Delta p}} \right)}$$

To calculate restrictor flow rate in mm:

$$Q \approx \frac{d^2_{orifice}}{2.144 \times \sqrt{\frac{SG}{\Delta p}}}$$

Where:

$d_{orifice}$ > Orifice diameter, measured in mm
Q > Fluid flow rate, measured in liters/minute
Δp > Fluid pressure difference across the restrictor, measured in bar
SG > Specific gravity of the fluid
2.144 > Constant = Unit conversion factor x CD

Please visit our web site for a more precise flow calculator formula.

METRIC

To calculate orifice length in mm:

L = (Ø x 0.207) + t
L = length of orifice (mm)
Ø = orifice diameter (mm)
t = see chart to right
Tolerance: +/– ((Ø x 0.021) + 0.13) mm

RE Size	t (mm)
4 mm	0.67
5 mm	0.76
6 mm	0.97
7 mm	0.89
8 mm	0.81
9 mm	1.14
10 mm	1.14

Hardness Conversion Table

For Hardening Carbon and Low Alloy Steel

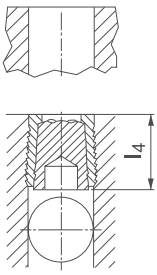
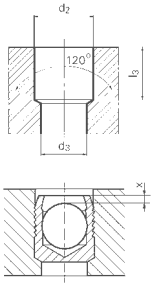
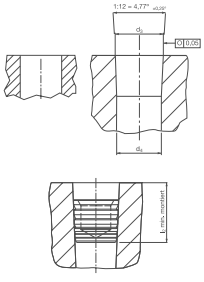
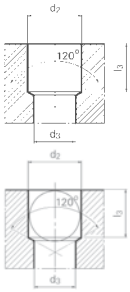
Tensile Strength 2) N/mm²	Vickers Hardness (F ≥ 98 n)	Brinell Hardness 1) $\left(0{,}102 \cdot \frac{F}{D^2} = 30 \frac{N}{mm^2}\right)$	Rockwell Hardness		
			HRB	HRC	HRA
255	80	76.0			
270	85	80.7	41.0		
285	90	85.5	48.0		
305	95	90.2	52.0		
320	100	95.0	56.2		
335	105	99.8			
350	110	105	62.3		
370	115	109			
385	120	114	66.7		
400	125	119			
415	130	124	71.2		
430	135	128			
450	140	133	75.0		
465	145	138			
480	150	143	78.7		
495	155	147			
510	160	152	81.7		
530	165	156			
545	170	162	85.0		
560	175	166			
575	180	171	87.1		
595	185	176			
610	190	181	89.5		
625	195	185			
640	200	190	91.5		
660	205	195	92.5		
675	210	199	93.5		
690	215	204	94.0		
705	220	209	95.0		
720	225	214	96.0		
740	230	219	96.7		
755	235	223			
770	240	228	98.1	20.3	60.7
785	245	233		21.3	61.2
800	250	238	99.5	22.2	61.6
820	255	242		23.1	62.0
835	260	247	(101)	24.0	62.4
850	265	252		24.8	62.7
865	270	257	(102)	25.6	63.1
880	275	261		26.4	63.5
900	280	268	(104)	27.1	63.8
915	285	271	(105)	27.8	64.2
930	290	276		28.5	64.5
950	295	280		29.2	64.8
965	300	285		29.8	65.2
995	310	295		31.0	65.8
1030	320	304		32.2	66.4
1060	330	314		33.3	67.0
1095	340	323		34.3	67.6
1125	350	333		35.5	68.1

Tensile Strength 2) N/mm²	Vickers Hardness (F ≥ 98 n)	Brinell Hardness 1) $\left(0{,}102 \cdot \frac{F}{D^2} = 30 \frac{N}{mm^2}\right)$	Rockwell Hardness		
			HRB	HRC	HRA
1155	360	342		36.6	68.7
1190	370	352		37.7	69.2
1220	380	361		38.8	69.8
1255	390	371		39.8	70.3
1290	400	380		40.8	70.8
1320	410	390		41.8	71.4
1350	420	399		42.7	71.8
1385	430	409		43.6	72.3
1420	440	418		44.5	72.8
1455	450	428		45.3	73.3
1485	460	437		46.1	73.6
1520	470	447		46.9	74.1
1555	480	(456)		47.7	74.5
1595	490	(466)		48.4	74.9
1630	500	(475)		49.1	75.3
1665	510	(485)		49.8	75.7
1700	520	(494)		50.5	76.1
1740	530	(504)		51.1	76.4
1775	540	(513)		51.7	76.7
1810	550	(523)		52.3	77.0
1845	560	(532)		53.0	77.4
1880	570	(542)		53.6	77.8
1920	580	(551)		54.1	78.0
1955	590	(561)		54.7	78.4
1995	600	(570)		55.2	78.6
2030	610	(580)		55.7	78.9
2070	620	(589)		56.3	79.2
2105	630	(599)		56.8	79.5
2145	640	(608)		57.3	79.8
2180	650	(618)		57.8	80.0
	660			58.3	80.3
	670			58.8	80.6
	680			59.2	80.8
	690			59.7	81.1
	700			60.1	81.3
	720			61.0	81.8
	740			61.8	82.2
	760			62.5	82.6
	780			63.3	83.0
	800			64.0	83.4
	820			64.7	83.8
	840			65.3	84.1
	860			65.9	84.4
	880			66.4	84.7
	900			67.0	85.0
	920			67.5	85.3
	940			68.0	85.6

Numbers in parentheses indicate hardness values, which are outside the definition area of the standard hardness test, but often used as approximate values.
The Brinell values in parenthesis are only used when measured with a hard metal ball.

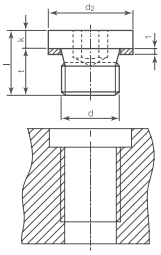
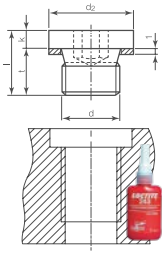
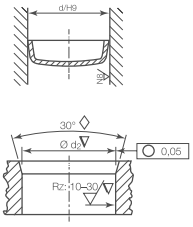
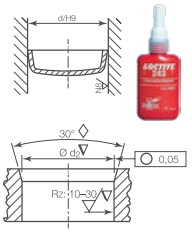
1) Calculated as: HB = 0.95 x HV
2) The tensile strength values shown in the table are only to be used as approximate values. To get the exact tensile strength values a tensile test must be performed.

SFC KOENIG EXPANDER® SYSTEMS / PRODUCT COMPARISON

Type of Sealing Element	Expander Series SK/LK	Expander Series MB/CV	Expander Series LP	Ball
Operations				
Bore	■	■	■	■
Bore (step)	□	■	□	□
Chamfering	□	□	□	■
Face Milling	□	□	□	(■[3])
Reaming	□	□	□	■
Tapping	□	□	□	□
Cleaning	■	■	■	■
Placing Sealant on Screw	□	□	□	□
Positioning of Element	■ By Setting Tool	■ Put Into Bore	■ By Setting Tool	■
Setting of Sealing Element	■ By Pulling the Mandrel	■ By Setting Tool	■ By Setting Tool	■ By Setting Tool
Cramping	□	□	□	■
Torque Check (in line)	□	□	□	□
Insertion-Control	(■[2])	(■[2])	(■[2])	(■[2])
Pressure Test	□ Upon Request Only	□ Upon Request Only	□ Upon Request Only	
Total No. of Operation	**4** (5)	**5** (6)	**4** (5)	**8** (10)
Warranty by Supplier	Provided	Provided	Provided	None
Expander Diameter Available	4 –12/4 –20 mm	3 – 22/4 –18 mm	4.4 –12.7 mm	

[1] = Without Bore Applicable as Well [2] = Optional Control Unit [3] = In Dependance on Assembly □ = Unnecessary ■ = Necessary

SFC KOENIG EXPANDER® SYSTEMS / PRODUCT COMPARISON

	Set Screw	Screwed Sealing Plug (metallic sealing)	Screwed Plug with Sealant (e.g. Loctite)	DIN Plug	DIN Plug
Operations					
Bore	■	■	■	■	■
Bore (step)	□	■	■	□	□
Chamfering	■	■	■	■	■
Face Milling	□	□	□	(■[3])	(■[3])
Reaming	□	□	□	■	■
Tapping	■	■	■	□	□
Cleaning	■	■	■	■	■
Placing Sealant on Screw	■	□	■	□	■
Positioning of Element	■	■	■	■ By Setting Tool	■ By Setting Tool
Setting of Sealing Element	■	■	■	■ By Pressing In	■ By Pressing In
Cramping	□	□	□	□	□
Torque Check (in line)	■	■[2]	■[2]	□	□
Insertion-Control	□	□	□	(■[2])	(■[2])
Pressure Test	■	■	■	■ Upon Request Only	■ Upon Request Only
Total No. of Operation	9	**9**	**10**	**7** (9)	**8** (10)
Warranty by Supplier	None	None	None	None	None

[1] = Without Bore Applicable as Well [2] = Optional Control Unit [3] = In Dependance on Assembly □ = Unnecessary ■ = Necessary

Tapping Drill Sizes

Metric Coarse Sizes

Tap Size	Drill Size
M1 x 0.25	0.75mm
M1.1 x 0.25	0.85mm
M1.2 x 0.25	0.95mm
M1.4 x 0.3	1.1mm
M1.6 x 0.35	1.25mm
M1.8 x 0.35	1.45mm
M2 x 0.4	1.6mm
M2.2 x 0.45	1.75mm
M2.5 x 0.45	2.05mm
M3 x 0.5	2.5mm
M3.5 x 0.6	2.9mm
M4 x 0.7	3.3mm
M4.5 x 0.75	3.7mm
M5 x 0.8	4.2mm
M6 x 1	5mm
M7 x 1	6mm
M8 x 1.25	6.8mm
M9 x 1.25	7.8mm
M10 x 1.5	8.5mm
M11 x 1.5	9.5mm
M12 x 1.75	10.2mm
M14 x 2	12mm
M16 x 2	14mm
M18 x 2.5	15.5mm
M20 x 2.5	17.5mm
M22 x 2.5	19.5mm
M24 x 3	21mm
M27 x 3	24mm
M30 x 3.5	26.5mm
M33 x 3.5	29.5mm
M36 x 4	32mm
M39 x 4	35mm
M42 x 4.5	37.5mm
M45 x 4.5	40.5mm
M48 x 5	43mm
M52 x 5	47mm
M56 x 5.5	50.5mm
M60 x 5.5	54.5mm
M64 x 6	58mm
M68 x 6	62mm

Metric Fine Sizes

Tap Size	Drill Size
M4 x 0.35	3.6mm
M4 x 0.5	3.5mm
M5 x 0.5	4.5mm
M6 x .5	5.5mm
M6 x .75	5.25mm
M7 x .75	6.25mm
M8 x .5	7mm
M8 x .75	7.25mm
M8 x 1	7.5mm
M9 x 1	8mm
M10 x 0.75	9.25mm
M10 x 1	9mm
M10 x 1.25	8.8mm
M11 x 1	10mm
M12 x .75	11.25mm
M12 x 1	11mm
M12 x 1.5	10.5mm
M14 x 1	13mm
M14 x 1.25	12.8mm
M14 x 1.5	12.5mm
M16 x 1	15mm
M16 x 1.5	15mm
M18 x 1	17mm
M18 x 2	16mm
M20 x 1	19mm
M20 x 1.5	18.5mm
M20 x 2	18mm
M22 x 1	21mm
M22 x 1.5	20.5mm
M22 x 2	20mm
M24 x 1.5	22.5mm
M24 x 2	22mm
M26 x 1.5	24.5mm
M27 x 1.5	25.5mm
M27 x 2	25mm
M28 x 1.5	26.5mm
M30 x 1.5	28.5mm
M30 x 2	28mm
M33 x 2	31mm
M36 x 3	33mm

Steel Hardness Testing Comparison Chart

Each hardness testing method does not test the same material properties at a given time

Brinell Hardness	Rockwell C	Rockwell B	Vickers	Tensile Strength
HB (10 mm Ball, 3000Kg Load)	HRC (Indenter 150Kg Load)	HRB (1/16 Ball, 100Kg Load)	HV (Diamond Indenter, 120Kg Load	N/mm²
800	72			
780	71			
760	70			
752	69			
745	68			
746	67			
735	66			
711	65			
695	64			
681	63			
658	62			
642	61			
627	60			
613	59			
601	58		746	
592	57		727	
572	56		694	
552	55		649	
534	54	120	589	
513	53	119	567	
504	52	118	549	
486	51	118	531	
469	50	117	505	
468	49	117	497	
456	48	116	490	1569
445	47	115	474	1520
430	46	115	458	1471
419	45	114	448	1447
415	44	114	438	1422
402	43	114	424	1390
388	42	113	406	1363
375	41	112	393	1314
373	40	111	388	1265
360	39	111	376	1236
348	38	110	361	1187
341	37	109	351	1157
331	36	109	342	1118
322	35	108	332	1089
314	34	108	320	1049

Continued on next page

Each hardness testing method does not test the same material properties at a given time

Brinell Hardness	Rockwell C	Rockwell B	Vickers	Tensile Strength
HB (10 mm Ball, 3000Kg Load)	HRC (Indenter 150Kg Load)	HRB (1/16 Ball, 100Kg Load)	HV (Diamond Indenter, 120Kg Load	N/mm²
308	33	107	311	1035
300	32	107	303	1020
290	31	106	292	990
277	30	105	285	971
271	29	104	277	941
264	28	103	271	892
262	27	103	262	880
255	26	102	258	870
250	25	101	255	853
245	24	100	252	838
240	23	100	247	824
233	22	99	241	794
229	21	98	235	775
223	20	97	227	755
216	19	96	222	716
212	18	95	218	706
208	17	95	210	696
203	16	94	201	680
199	15	93	199	667
191	14	92	197	657
190	13	92	186	648
186	12	91	184	637
183	11	90	183	617
180	10	89	180	608
175	9	88	178	685
170	7	87	175	559
167	6	86	172	555
166	5	86	168	549
163	4	85	162	539
160	3	84	160	535
156	2	83	158	530
154	1	82	152	515
149		81	149	500
147		80	147	490
143		79	146	482
141		78	144	481
139		77	142	480
137		76	140	475
135		75	137	467

Continued on next page

Steel Hardness Testing Comparison Chart

Each hardness testing method does not test the same material properties at a given time

Brinell Hardness	Rockwell C	Rockwell B	Vickers	Tensile Strength
HB (10 mm Ball, 3000Kg Load)	HRC (Indenter 150Kg Load)	HRB (1/16 Ball, 100Kg Load)	HV (Diamond Indenter, 120Kg Load	N/mm²
131		74	134	461
127		72	129	451
121		70	127	431
116		68	124	422
114		67	121	412
111		66	118	402
107		64	115	382
105		62	112	378
103		61	108	373
95		56	104	
90		52	95	
81		41	85	
76		37	80	

ISO Limits and Fits for Holes

The ISO system for limits and fits is a generally recognised method for manufacturing processes where there are corresponding holes and shafts.

ISO Tolerances for Holes																				
Metric Nominal hole sizes																				
over	3	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355
inc.	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	400
Metric Limits in Micrometres (Where there is no - take as +)																				
E6	28	34	43	53	66		79		94		110				129		142		161	
	20	25	32	40	50		60		72		85				100		110		125	
E7	32	40	50	61	75		90		107		125				146		162		185	
	20	25	32	40	50		60		72		85				100		110		125	
E11	95	115	142	170	210		250		292		335				390		430		485	
	20	25	32	40	50		60		72		85				100		110		125	
E12	140	175	212	250	300		360		422		485				560		630		695	
	20	25	32	40	50		60		72		85				100		110		125	
E13	200	245	302	370	440		520		612		715				820		920		+1 015	
	20	25	32	40	50		60		72		85				100		110		125	
F6	18	22	27	33	41		49		58		68				79		88		98	
	10	13	16	20	2		30		36		43				50		56		62	
F7	22	28	34	41	50		60		71		83				96		108		119	
	10	13	16	20	25		30		36		43				50		56		62	
F8	28	35	43	53	64		76		90		106				122		137		151	
	10	13	16	20	25		30		36		43				50		56		62	
G6	12	14	17	20	25		29		34		39				44		49		54	
	4	5	6	7	9		10		12		14				15		17		18	
G7	16	20	24	28	34		40		47		54				61		69		75	
	4	5	6	7	9		10		12		14				15		17		18	
G8	22	27	33	40	48		56		66		77				87		98		107	
	4	5	6	7	9		10		12		14				15		17		18	
H6	8	9	11	13	16		19		22		25				29		32		36	
	0	0	0	0	0		0		0		0				0		0		0	
H7	12	15	18	21	25		30		35		40				46		52		57	
	0	0	0	0	0		0		0		0				0		0		0	
H8	18	22	27	33	39		46		54		63				72		81		89	
	0	0	0	0	0		0		0		0				0		0		0	
H9	30	36	43	52	62		74		87		100				115		130		140	
	0	0	0	0	0		0		0		0				0		0		0	
H10	48	58	70	84	100		120		140		160				185		210		230	
	0	0	0	0	0		0		0		0				0		0		0	
H11	75	90	110	130	160		190		220		250				290		320		360	
	0	0	0	0	0		0		0		0				0		0		0	
J6	5	5	6	8	10		13		16		18				22		25		29	
	-3	-4	-5	-5	-6		-6		-6		-7				-7		-7		-7	
J7	6	8	10	12	14		18		22		26				30		36		39	
	-6	-7	-8	-9	-11		-12		-13		-14				-16		-16		-18	

Continued on next page

ISO Limits and Fits for Holes

ISO Tolerances for Holes																				
Metric Nominal hole sizes																				
over	3	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355
inc.	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	400
Metric Limits in Micrometres (Where there is no - take as +)																				
J8	10	+12	15	20	+24		+28		+34		41			+47			+55		60	
	-8	-10	-12	-13	-15		-18		-20		-22			-25			-26		-29	
JS6	4	4.5	5.5	6.5	+8		+9.5		+11		12.5			+14.5			+16		18	
	-4	-4.5	-5.5	-6.5	-8		-9.5		-11		-12.5			-14.5			-16		-18	
JS7	6	7.5	9	10.5	+12.5		+15		+17.5		20			+23			+26		28.5	
	-6	-7.5	-9	-10.5	-12.5		-15		-17.5		-20			-23			-26		-28.5	
JS8	9	+11	13.5	16.5	+19.5		+23		+27		31.5			+36			+40.5		44.5	
	-9	-11	-13.5	-16.5	-19.5		-23		-27		-31.5			-36			-40.5		-44.5	
K6	2	+2	2	2	+3		+4		+4		4			+5			+5		7	
	-6	-7	-9	-11	-13		-15		-18		-21			-24			-27		-29	
K7	3	+5	6	6	+7		+9		+10		12			+13			+16		17	
	-9	-10	-12	-15	-18		-21		-25		-28			-33			-36		-40	
K8	5	+6	8	10	+12		+14		+16		+20			+22			+25		28	
	-13	-16	-19	-23	-27		-32		-38		-43			-50			-56		-61	
M6	-1	-3	-4	-4	-4		-5		-6		-8			-8			-9		-10	
	-9	-12	-15	-17	-20		-24		-28		-33			-37			-41		-46	
M7	0	0	0	0	0		0		0		0			0			0		0	
	-12	-15	-18	-21	-25		-30		-35		-40			-46			-52		-57	
M8	2	+1	2	4	+5		+5		6		8			9			9		11	
	-16	-21	-25	-29	-34		-41		-48		-55			-63			-72		-78	
N6	-5	-7	-9	-11	-12		-14		-16		-20			-22			-25		-26	
	-13	-16	-20	-24	-28		-33		-38		-45			-51			-57		-62	
N7	-4	-4	-5	-7	-8		-9		-10		-12			-14			-14		-16	
	-16	-19	-23	-28	-33		-39		-45		-52			-60			-66		-73	
N8	-2	-3	-3	-3	-3		-4		-4		-4			-5			-5		-5	
	-20	-25	-30	-36	-42		-50		-58		-67			-77			-86		-94	
P6	-9	-12	-15	-18	-21		-26		-30		-36			-41			-47		-51	
	-17	-21	-26	-31	-37		-45		-52		-61			-70			-79		-87	
P7	-8	-9	-11	-14	-17		-21		-24		-28			-33			-36		-41	
	-20	-24	-29	-35	-42		-51		-59		-68			-79			-88		-98	
P8	-12	-15	-18	-22	-26		-32		-37		-43			-50			-56		-62	
	-30	-37	-45	-55	-65		-78		-91		-106			-122			-137		-151	
R6	-12	-16	-20	-24	-29		-35	-37	-44	-47	-56	-58	-61	-68	-71	-75	-85	-89	-97	-103
	-20	-25	-31	-37	-45		-54	-56	-66	-69	-81	-83	-86	-97	-100	-104	-117	-121	-133	-139
R7	-11	-13	-16	-20	-25		-30	-32	-38	-41	-48	-50	-53	-60	-63	-67	-74	-78	-87	-93
	-23	-28	-34	-41	-50		-60	-62	-73	-76	-88	-90	-93	-106	-109	-113	-126	-130	-144	-150

ISO Limits and Fits for Shafts

The ISO system for limits and fits is a generally recognised method for manufacturing processes where there are corresponding holes and shafts.

ISO Tolerances for Shafts																				
Metric Nominal Shaft Sizes																				
over	3	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355
inc.	6	10	18	30	40	50	65	80	100	120	140	160	180	200	225	250	280	315	355	400
Metric Limits in Micrometres (Where there is no - take as +)																				
a12	-270	-280	-290	-300	-310	-320	-340	-360	-380	-410	-460	-520	-580	-660	-740	-820	-920	-1050	-1200	-1350
	-390	-430	-470	-510	-560	-570	-640	-660	-730	-760	-860	-920	-980	-1120	-1200	-1280	-1440	-1570	-1770	-1920
d6	-30	-40	-50	-65	-80		-100		-120			-145			-170			-190		-210
	-38	-49	-61	-78	-96		-119		-142			-170			-199			-222		-246
e6	-20	-25	-32	-40	-50		-60		-72			-85			-100			-110		-125
	-28	-34	-43	-53	-66		-79		-94			-110			-129			-142		-161
e13	-20	-25	-32	-40	-50		-60		-72			-85			-100			-110		-125
	-200	-245	-302	-370	-440		-520		-612			-715			-820			-920		-1015
f5	-10	-13	-16	-20	-25		-30		-36			-43			-50			-56		-62
	-15	-19	-24	-29	-36		-43		-51			-61			-70			-79		-87
f6	-10	-13	-16	-20	-25		-30		-36			-43			-50			-56		-62
	-18	-22	-27	-33	-41		-49		-58			-68			-79			-88		-98
f7	-10	-13	-16	-20	-25		-30		-36			-43			-50			-56		-62
	-22	-28	-34	-41	-50		-60		-71			-83			-96			-108		-119
g5	-4	-5	-6	-7	-9		-10		-12			-14			-15			-17		-18
	-9	-11	-14	-16	-20		-23		-27			-32			-35			-40		-43
g6	-4	-5	-6	-7	-9		-10		-12			-14			-15			-17		-18
	-12	-14	-17	-20	-25		-29		-34			-39			-44			-49		-54
g7	-4	-5	-6	-7	-9		-10		-12			-14			-15			-17		-18
	-16	-20	-24	-28	-34		-40		-47			-54			-61			-69		-75
h4	0	0	0	0	0		0		0			0			0			0		0
	-4	-4	-5	-6	-7		-8		-10			-12			-14			-16		-18
h5	0	0	0	0	0		0		0			0			0			0		0
	-5	-6	-8	-9	-11		-13		-15			-18			-20			-23		-25
h6	0	0	0	0	0		0		0			0			0			0		0
	-8	-9	-11	-13	-16		-19		-22			-25			-29			-32		-36
h7	0	0	0	0	0		0		0			0			0			0		0
	-12	-15	-18	-21	-25		-30		-35			-40			-46			-52		-57
h8	0	0	0	0	0		0		0			0			0			0		0
	-18	-22	-27	-33	-39		-46		-54			-63			-72			-81		-89
h9	0	0	0	0	0		0		0			0			0			0		0
	-30	-36	-43	-52	-62		-74		-87			-100			-115			-130		-140
h10	0	0	0	0	0		0		0			0			0			0		0
	-48	-58	-70	-84	-100		-120		-140			-160			-185			-210		-230
h11	0	0	0	0	0		0		0			0			0			0		0
	-75	-90	-110	-130	-160		-190		-220			-250			-290			-320		-360

Continued on next page

ISO Limits and Fits for Shafts

h12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	-120	-150	-180	-210	-250	-300	-350	-400	-460	-520	-570											
j5	3	4	5	5	6	6	6	7	7	7	7											
	-2	-2	-3	-4	-5	-7	-9	-11	-13	-16	-18											
j6	6	7	8	9	11	12	13	14	16	16	18											
	-2	-2	-3	-4	-5	-7	-9	-11	-13	-16	-18											
j7	8	10	12	13	15	18	20	22	25	26	29											
	-4	-5	-6	-8	-10	-12	-15	-18	-21	-26	-28											
js5	2.5	3	4	4.5	5.5	6.5	7.5	9	10	11.5	12.5											
	-2.5	-3	-4	-4.5	-5.5	-6.5	-7.5	-9	-10	-11.5	-12.5											
js6	4	4.5	5.5	6.5	8	9.5	11	12.5	14.5	16	18											
	-4	-4.5	-5.5	-6.5	-8	-9.5	-11	-12.5	-14.5	-16	-18											
js7	6	7.5	9	10.5	12.5	15	17.5	20	23	26	28.5											
	-6	-7.5	-9	-10.5	-12.5	-15	-17.5	-20	-23	-26	-28.5											
k5	6	7	9	11	13	15	18	21	24	27	29											
	1	1	1	2	2	2	3	3	4	4	4											
k6	9	10	12	15	18	21	25	28	33	36	40											
	1	1	1	2	2	2	3	3	4	4	4											
k7	13	16	19	23	27	32	38	43	50	56	61											
	1	1	1	2	2	2	3	3	4	4	4											
m5	9	12	15	17	20	24	28	33	37	43	46											
	4	6	7	8	9	11	13	15	17	20	21											
m6	12	15	18	21	25	30	35	40	46	52	57											
	4	6	7	8	9	11	13	15	17	20	21											
m7	16	21	25	29	34	41	48	55	63	72	78											
	4	6	7	8	9	11	13	15	17	20	21											
n5	13	16	20	24	28	33	38	45	51	57	62											
	8	10	12	15	17	20	23	27	31	34	37											
n6	16	19	23	28	33	39	45	52	60	66	73											
	8	10	12	15	17	20	23	27	31	34	37											
n7	20	25	30	36	42	50	58	67	77	86	94											
	8	10	12	15	17	20	23	27	31	34	37											
p5	17	21	26	31	37	45	52	61	70	79	87											
	12	15	18	22	26	32	37	43	50	56	62											
p6	20	24	29	35	42	51	59	68	79	88	98											
	12	15	18	22	26	32	37	43	50	56	62											
r6	23	28	34	41	50	60	62	73	76	88	90	93	106	109	113	126	130	144	150			
	15	19	23	28	34	41	43	51	54	63	65	68	77	80	84	94	98	108	114			

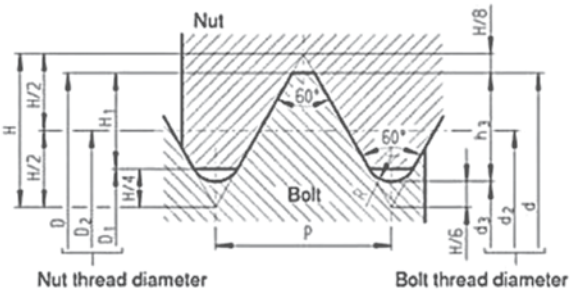
ISO Limits and Fits Summary

The ISO system for limits and fits is a generally recognised method for manufacturing processes where there are corresponding holes and shafts.

		ISO Symbols	
Fit Type	**Description**	**Hole Tolerances**	**Shaft Tolerances**
Clearance Fits	Loose fit	H11	c11
	Free running	H9	d9
	Easy running	H8	f8
	Sliding fit	H7	g6
	Close clearance	H8	f7
	Location clearance	H7	h6
Transition Fits	Slight interference	H7	k6
	Transition	H7	n6
Interference Fits	Press fit	H7	p6
	Medium fit	H7	s6
	Force fit	H7	u6

Metric Coarse Thread

Threaded fasteners, bolts, nuts, screws and fastenings



$H = 0.86603\ P$

$H_1 = 0.54127\ P$

$h_3 = 0.61343\ P$

$R = \frac{H}{6} = 0.14434\ P$

$D_1 \quad d = 2H_1$

$d_2 \quad D_2 \quad d = 0.64952\ P$

$d_3 \quad d = 1.22687\ P$

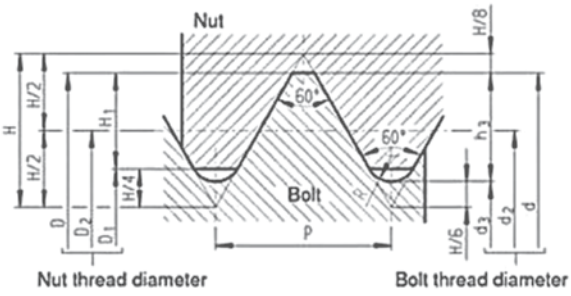
ISO Metric Coarse	PITCH	Major Diameter	Root Radius	Pitch Diameter	Minor Dia. Male Thread	Minor Dia. Female Thread	Thread Height Male Thread	Thread Height Female Thread	Tap Drill
	P	d=D	r	d2=D2	d3	D1	h3	H1	
M1	0.25	1.00	0.036	0.838	0.693	0.729	0.153	0.135	0.75
M1.1	0.25	1.10	0.036	0.938	0.793	0.829	0.153	0.135	0.85
M1.2	0.25	1.20	0.036	1.038	0.893	0.929	0.153	0.135	0.95
M1.4	0.30	1.40	0.043	1.205	1.032	1.075	0.184	0.162	1.10
M1.6	0.35	1.60	0.051	1.373	1.171	1.221	0.215	0.189	1.25
M1.8	0.35	1.80	0.051	1.573	1.371	1.421	0.215	0.189	1.45
M2	0.40	2.00	0.058	1.740	1.509	1.567	0.245	0.217	1.60
M2.2	0.45	2.20	0.065	1.908	1.648	1.713	0.276	0.244	1.75
M2.5	0.45	2.50	0.065	2.208	1.948	2.013	0.276	0.244	2.05
M3	0.50	3.00	0.072	2.675	2.387	2.459	0.307	0.271	2.50
M3.5	0.60	3.50	0.087	3.110	2.764	2.850	0.368	0.325	2.90
M4	0.70	4.00	0.101	3.545	3.141	3.242	0.429	0.379	3.30
M4.5	0.75	4.50	0.108	4.013	3.580	3.688	0.460	0.406	3.80
M5	0.80	5.00	0.115	4.480	4.019	4.134	0.491	0.433	4.20
M6	1.00	6.00	0.144	5.350	4.773	4.917	0.613	0.541	5.00
M7	1.00	7.00	0.144	6.350	5.773	5.917	0.613	0.541	6.00
M8	1.25	8.00	0.180	7.188	6.466	6.647	0.767	0.677	6.80
M9	1.25	9.00	0.180	8.188	7.466	7.647	0.767	0.677	7.80
M10	1.50	10.00	0.217	9.026	8.160	8.376	0.920	0.812	8.50
M11	1.50	11.00	0.217	10.026	9.160	9.376	0.920	0.812	9.50
M12	1.75	12.00	0.253	10.863	9.853	10.106	1.074	0.947	10.20
M14	2.00	14.00	0.289	12.701	11.546	11.835	1.227	1.083	12.00
M16	2.00	16.00	0.289	14.701	13.546	13.835	1.227	1.083	14.00
M18	2.50	18.00	0.361	16.376	14.933	15.394	1.534	1.353	15.50
M20	2.50	20.00	0.361	18.376	16.933	17.294	1.534	1.353	17.50
M22	2.50	22.00	0.361	20.376	18.933	19.294	1.534	1.353	19.50

Continued on next page

ISO Metric Coarse	PITCH	Major Diameter	Root Radius	Pitch Diameter	Minor Dia. Male Thread	Minor Dia. Female Thread	Thread Height Male Thread	Thread Height Female Thread	Tap Drill
	P	d=D	r	d2=D2	d3	D1	h3	H1	
M24	3.00	24.00	0.433	22.051	20.319	20.752	1.840	1.624	21.00
M27	3.00	27.00	0.433	25.051	23.319	23.752	1.840	1.624	24.00
M30	3.50	30.00	0.505	27.727	25.706	26.211	2.147	1.894	26.50
M33	3.50	33.00	0.505	30.727	28.706	29.211	2.147	1.894	29.50
M36	4.00	36.00	0.577	33.402	31.093	31.670	2.454	2.165	32.00
M39	4.00	39.00	0.577	36.402	34.093	34.670	2.454	2.165	35.00
M42	4.50	42.00	0.650	39.077	36.479	37.129	2.760	2.436	37.50
M45	4.50	45.00	0.650	42.077	39.479	40.129	2.760	2.436	40.50
M48	5.00	48.00	0.722	44.752	41.866	42.857	3.067	2.706	43.00
M52	5.00	52.00	0.722	48.752	45.866	46.587	3.067	2.706	47.00
M56	5.50	56.00	0.794	52.428	49.252	50.046	3.374	2.977	50.50
M60	5.50	60.00	0.794	56.428	53.252	54.046	3.374	2.977	54.50
M64	6.00	64.00	0.866	60.103	56.639	57.505	3.681	3.248	58.00
M68	6.00	68.00	0.866	64.103	60.639	61.505			

Metric Fine Threads

Threaded fasteners, bolts, nuts, screws and fastenings



$H = 0.86603\ P$

$H_1 = 0.54127\ P$

$h_3 = 0.61343\ P$

$R = \frac{H}{6} = 0.14434\ P$

$D_1 \quad d = 2H_1$

$d_2 \quad D_2 \quad d = 0.64952\ P$

$d_3 \quad d = 1.22687\ P$

ISO Metric Fine	PITCH	Major Diameter	Root Radius	Pitch Diameter	Minor Dia. Male Thread	Minor Dia. Female Thread	Thread Height Male Thread	Thread Height Female Thread	Tap Drill
	P	d=D	r	d2=D2	d3	D1	h3	H1	
M1	0.20	1.0	0.029	0.870	0.755	0.783	0.123	0.108	0.80
M1.1	0.20	1.1	0.029	0.970	0.855	0.883	0.123	0.108	0.90
M1.2	0.20	1.2	0.029	1.070	0.955	0.983	0.123	0.108	1.00
M1.4	0.20	1.4	0.029	1.270	1.155	1.183	0.123	0.108	1.20
M1.6	0.20	1.6	0.029	1.470	1.355	1.383	0.123	0.108	1.40
M1.8	0.20	1.8	0.029	1.670	1.555	1.583	0.123	0.108	1.60
M2	0.25	2.0	0.036	1.838	1.693	1.729	0.153	0.135	1.75
M2.2	0.25	2.2	0.036	2.038	1.893	1.929	0.153	0.135	1.95
M2.5	0.35	2.5	0.051	2.273	2.071	2.121	0.215	0.189	2.10
M3	0.35	3.0	0.051	2.773	2.571	2.621	0.215	0.189	2.60
M3.5	0.35	3.5	0.051	3.273	3.071	3.121	0.215	0.189	3.10
M4	0.50	4.0	0.072	3.675	3.387	3.459	0.307	0.271	3.50
M4.5	0.50	4.5	0.072	4.175	3.887	3.959	0.307	0.271	4.00
M5	0.50	5.0	0.072	4.675	4.387	4.459	0.307	0.271	4.50
M5.5	0.50	5.5	0.072	5.175	4.887	4.959	0.307	0.271	5.00
M6	0.75	6.0	0.108	5.513	5.080	5.188	0.460	0.406	5.20
M7	0.75	7.0	0.108	6.513	6.080	6.188	0.460	0.406	6.20
M8	0.75	8.0	0.108	7.513	7.080	7.188	0.460	0.406	7.20
M8	1.00	8.0	0.144	7.350	6.773	6.917	0.613	0.541	7.00
M9	0.75	9.0	0.108	8.513	8.080	8.188	0.460	0.406	8.20
M9	1.00	9.0	0.144	8.350	7.773	7.917	0.613	0.541	8.00
M10	0.75	10.0	0.108	9.513	9.080	9.188	0.460	0.406	9.20
M10	1.00	10.0	0.144	9.350	8.773	8.917	0.613	0.541	9.00
M10	1.25	10.0	0.180	9.188	8.466	8.647	0.767	0.677	8.80
M11	0.75	11.0	0.108	10.513	10.080	10.188	0.460	0.406	10.20
M11	1.00	11.0	0.144	10.350	9.773	9.917	0.613	0.541	10.00

Continued on next page

ISO Metric Fine	PITCH	Major Diameter	Root Radius	Pitch Diameter	Minor Dia. Male Thread	Minor Dia. Female Thread	Thread Height Male Thread	Thread Height Female Thread	Tap Drill
	P	d=D	r	d2=D2	d3	D1	h3	H1	
M12	1.00	12.0	0.144	11.350	10.773	10.917	0.613	0.541	11.00
M12	1.25	12.0	0.180	11.188	10.466	10.647	0.767	0.677	10.80
M12	1.50	12.0	0.217	11.026	10.160	10.376	0.920	0.812	10.50
M14	1.00	14.0	0.144	13.350	12.773	12.917	0.613	0.541	13.00
M14	1.25	14.0	0.180	13.188	12.466	12.647	0.767	0.677	12.80
M14	1.50	14.0	0.217	13.026	12.160	12.376	0.920	0.812	12.50
M15	1.00	15.0	0.144	14.350	13.773	13.917	0.613	0.541	14.00
M15	1.50	15.0	0.217	14.026	13.160	13.376	0.920	0.812	13.50
M16	1.00	16.0	0.144	15.350	14.773	14.917	0.613	0.541	15.00
M16	1.50	16.0	0.217	15.026	14.160	14.376	0.920	0.812	14.50
M17	1.00	17.0	0.144	16.350	15.773	15.917	0.613	0.541	16.00
M17	1.50	17.0	0.217	16.026	15.160	15.376	0.920	0.812	15.50
M18	1.00	18.0	0.144	17.350	16.773	16.917	0.613	0.541	17.00
M18	1.50	18.0	0.217	17.026	16.160	16.376	0.920	0.812	16.50
M18	2.00	18.0	0.289	16.701	15.546	15.835	1.227	1.083	16.00
M20	1.00	20.0	0.144	19.350	18.773	18.917	0.613	0.541	19.00
M20	1.50	20.0	0.217	19.026	18.160	18.376	0.920	0.812	18.50
M20	2.00	20.0	0.289	18.701	17.546	17.835	1.227	1.083	18.00
M22	1.00	22.0	0.144	21.350	20.773	20.917	0.613	0.541	21.00
M22	1.50	22.0	0.217	21.026	20.160	20.376	0.920	0.812	20.50
M22	2.00	22.0	0.289	20.701	19.546	19.835	1.227	1.083	20.00
M24	1.00	24.0	0.144	23.350	22.773	22.917	0.613	0.541	23.00
M24	1.50	24.0	0.217	23.026	22.160	22.376	0.920	0.812	22.50
M24	2.00	24.0	0.289	22.701	21.546	21.835	1.227	1.083	22.00
M25	1.00	25.0	0.144	24.350	23.773	23.917	0.613	0.541	24.00
M25	1.50	25.0	0.217	24.026	23.160	23.376	0.920	0.812	23.50
M25	2.00	25.0	0.289	23.701	22.546	22.835	1.227	1.083	23.00
M27	1.00	27.0	0.144	26.350	25.773	25.917	0.613	0.541	26.00
M27	1.50	27.0	0.217	26.026	25.160	25.376	0.920	0.812	25.50
M27	2.00	27.0	0.289	25.701	24.546	24.835	1.227	1.083	25.00
M28	1.00	28.0	0.144	27.350	26.773	26.917	0.613	0.541	27.00
M28	1.50	28.0	0.217	27.026	26.160	26.376	0.920	0.812	26.50
M28	2.00	28.0	0.289	26.701	25.546	25.835	1.227	1.083	26.00
M30	1.00	30.0	0.144	29.350	28.773	28.917	0.613	0.541	29.00
M30	1.50	30.0	0.217	29.026	28.160	28.376	0.920	0.812	28.50
M30	2.00	30.0	0.289	28.701	27.546	27.835	1.227	1.083	28.00
M30	3.00	30.0	0.433	28.051	26.319	26.752	1.840	1.624	27.00
M32	1.50	32.0	0.217	31.026	30.160	30.376	0.920	0.812	30.50
M32	2.00	32.0	0.289	30.701	29.546	29.835	1.227	1.083	30.00
M33	1.50	33.0	0.217	32.026	31.160	31.376	0.920	0.812	31.50
M33	2.00	33.0	0.289	31.701	30.546	30.835	1.227	1.083	31.00
M33	3.00	33.0	0.433	31.051	29.319	29.752	1.840	1.624	30.00
M35	1.50	35.0	0.217	34.026	33.160	33.376	0.920	0.812	33.50
M35	2.00	35.0	0.289	33.701	32.546	32.835	1.227	1.083	33.00
M36	1.50	36.0	0.217	35.026	34.160	34.376	0.920	0.812	34.50
M36	2.00	36.0	0.289	34.701	33.546	33.835	1.227	1.083	34.00
M36	3.00	36.0	0.433	34.051	32.319	32.752	1.840	1.624	33.00
M39	1.50	39.0	0.217	38.026	37.160	37.376	0.920	0.812	37.50
M39	2.00	39.0	0.289	37.701	36.546	36.835	1.227	1.083	37.00
M39	3.00	39.0	0.433	37.051	35.319	35.752	1.840	1.624	36.00
M40	1.50	40.0	0.217	39.026	38.160	38.376	0.920	0.812	38.50
M40	3.00	40.0	0.433	38.051	36.619	36.752	1.840	1.624	37.00

Continued on next page

Metric Fine Threads

ISO Metric Fine	PITCH	Major Diameter	Root Radius	Pitch Diameter	Minor Dia. Male Thread	Minor Dia. Female Thread	Thread Height Male Thread	Thread Height Female Thread	Tap Drill
	P	d=D	r	d2=D2	d3	D1	h3	H1	
M42	1.50	42.0	0.217	41.026	40.160	40.376	0.920	0.812	40.50
M42	2.00	42.0	0.289	40.701	39.546	39.835	1.227	1.083	40.00
M42	3.00	42.0	0.433	40.051	38.319	38.752	1.840	1.624	39.00
M42	4.00	42.0	0.577	39.402	37.093	37.670	2.454	2.165	38.00
M45	1.50	45.0	0.217	44.026	43.160	43.376	0.920	0.812	43.50
M45	2.00	45.0	0.289	43.701	42.546	42.835	1.227	1.083	43.00
M45	3.00	45.0	0.433	43.051	41.319	41.752	1.840	1.624	42.00
M45	4.00	45.0	0.577	42.402	40.093	40.670	2.454	2.165	41.00
M48	1.50	48.0	0.217	47.026	46.160	46.376	0.920	0.812	46.50
M48	2.00	48.0	0.289	46.701	45.546	45.835	1.227	1.083	46.00
M48	3.00	48.0	0.433	46.051	44.319	44.752	1.840	1.624	45.00
M48	4.00	48.0	0.577	45.402	43.093	43.670	2.454	2.165	44.00
M50	1.50	50.0	0.217	49.026	48.160	48.376	0.920	0.812	48.50
M50	2.00	50.0	0.289	48.701	47.546	47.835	1.227	1.083	48.00
M50	3.00	50.0	0.433	48.051	46.319	46.752	1.840	1.624	47.00
M52	1.50	52.0	0.217	51.026	50.160	50.376	0.920	0.812	50.50

Contents

Contents

Product **Page**

Contents

Contents

General Conditions of Sale

1 GENERAL

(a) Save as otherwise agreed in writing by Boneham & Turner Limited ('The Company'), these conditions shall govern the contract to the entire exclusion of any other express or implied conditions.

(b) Descriptions, illustrations and particulars of goods contained in the Company's price lists catalogues or other advertising material shall not form part of the contract unless specifically included.

(c) If the goods required for any special use not reasonably to be inferred by the Company, the customer shall disclose such use before the Contract is entered into.

2 PERFORMANCE

(a) The Company warrants that the goods shall at the time of delivery correspond with the specifications agreed (subject to any specified tolerance limits) and be free from defects in workmanship and materials. If any goods do not conform to this warranty the Company will at its option:
(i) replace the goods found not to conform to the warranty or
(ii) take such steps as the Company deems necessary to bring goods into conformity with the agreed specifications (subject as aforesaid) and into a state where they are free from such defects; or
(iii) take back the goods found not to conform to the warranty and refund the appropriate part of the purchase price.
Provided that the liability of the Company shall in no event exceed the purchase price of the goods, and performance of any one of the above options shall constitute an entire discharge of the Company's liability under this warranty.

(b) The foregoing warranty is conditional upon:
(i) the customer giving notice to the Company of the alleged defect or failure to correspond with specification immediately the customer discovers or ought to have discovered the same;
(ii) the customer affording the Company a reasonable opportunity to inspect the goods; and
(iii) the customer making no further use of the goods that are alleged to be defective or which do not correspond with specification after the time agreed the customer discovers or ought to have discovered the same.

(c) Save as provided in paragraph (a) of this Condition:
(i) all conditions and warranties, express or implied, as to the quality or fitness for any purpose of the goods are hereby expressly excluded; and
(ii) the Company shall be under no liability for any loss or damage (whether direct, indirect or consequential) howsoever arising which may be suffered by the customer.

(d) in the event that, notwithstanding the foregoing provisions of this Condition, the Company is found liable for any loss or damage suffered by the customer, that liability shall in no event exceed the purchase price of the goods.

(e) The foregoing provisions of this Condition shall not apply to sales which are made to persons who deal as consumers (as the expression is defined in Section 12 of the Unfair Contract Terms Act 1977).

3 PRICE

(a) The price payable for each consignment of goods exstock will be the Company's list price last published on the date on which that consignment is delivered to the customer.

(b) In the case of goods which are not exstock the Company reserves the right to increase the contract price at any time after the date of the contract by such additional sums as may from time to time be necessary to cover increased costs due to:
(i) alteration of the customer's requirements;
(ii) suspension of work due to lack of or on the customer's instructions;
(iii) any variation in costs of materials, labour, overheads or transport, or in conforming to any Act of Parliament or Order, Regulation or bye-laws made by any competent National or Local Authority arising after the date of the contract. Further in the case of specials the Company shall be entitled to deliver up to 110% of the quantity ordered and to increase the contract price accordingly.

(c) The contract price is exclusive of Value Added Tax or any similar taxes, levies or duties, which will be added to or charged on invoices at the appropriate rate.

(d) There is no minimum order value, but credit sales of goods having a total net value (exclusive of VAT, carriage, packing or postage) will be subject to an administration charge to cover the relatively high cost of processing such orders. See catalogue for details.

4 PAYMENT

Unless otherwise agreed in writing, the customer shall pay for the goods by cash on delivery. Where an order is designated as a credit order, payment shall be made on or before the tenth day of the month following the month of the invoice date. If the customer fails to make any payment in accordance with the agreed terms, the Company shall be entitled to charge interest at the rate of 3% per annum over the base rate of National Westminster Bank Limited on a day to day basis for the time being an all overdue payments.

5 DELIVERY

(a) A date or period of delivery agreed by the Company shall be an estimate only. Every effort will be made to adhere to delivery dates, but the Company accepts no liability for any direct or any consequential loss or damage arising from delay in delivery or despatch, in particular where such delay is caused by lack of instructions from the customer, strikes, lock-outs, other industrial action, failure of the Company's suppliers to fulfil their obligations, or any other cause beyond the Company's reasonable control.

(b) Unless otherwise stated, the price quoted is for the supply of the goods exworks and unpacked. All packing, postage and other costs of delivery, and costs of storage following any failure by the customer to take delivery, will be subject to an extra charge.

(c) If the customer being a company shall pass a resolution or suffer an order of a court to be made for its winding-up, or if a receiver shall be appointed, or being an individual or partnership shall suspend payment or propose or enter into any composition with creditors or suffer a receiving order in bankruptcy, then the Company may without prejudice to any other right rescind the contract, or suspend or cancel delivery or recover the possession of any goods for which payment in full has not been received.

6 RISK AND PROPERTY

(a) The risk in the goods shall pass to the customer upon delivery of the goods to him or any carrier acting on his behalf.

(b) The property in the goods shall not pass to the customer until the price of the goods and any other goods delivered by the Company to the customer is paid.

In the event of the customer failing to pay for the goods, then all such goods of the Company not paid for shall be handed over to the Company on demand and the Company is hereby granted a licence to enter into the customer's premises for the purposes of recovering such property.

Without prejudice to the generality of the foregoing, if the said goods are sold by the customer then the Company's beneficial interest shall attach to any proceeds of such sale and the customer shall forthwith hand over to the Company any proceeds of such sale and the Company shall be entitled to call upon the customer to assign all claims that the customer may have in respect of such sale.

7 COPYRIGHT

All designs, drawings, plans or models prepared by the Company for the customer's information remain the Company's property and copyright, and neither they nor any copies thereof must be made use of by any person without the Company's written consent. In respect of any goods supplied to the customer the design or specification whereof shall have been supplied by the customer, the customer accepts responsibility for any claims which may arise in respect of the making, supplying or using for the purposes of the contract of any patented invention or process or registered design, and the customer agrees to indemnify the company against any action, claim or proceeding for infringement or alleged infringement in respect thereof.

8 CANCELLATION

Contracts are not subject to cancellation without the Company's written consent. Where cancellation is accepted, the Company shall in addition to any express terms of acceptance of cancellation be entitled to reimbursement of any costs incurred by the Company in connection with the contract.

9 FORCE MAJEURE

The Company shall have the right to cancel or to reduce the volume of the goods delivered if it is prevented from or hindered in delivering the goods through any circumstances beyond its control including (but not limited to) industrial action, war , fire, or prohibition or enactment of any kind, without incurring any liability for any loss or damage whatsoever resulting therefrom.

10 ARBITRATION

At the option of either party in writing, any question, dispute or difference arising between the Company and the customer in relation to the contract shall be referred to the arbitration in England of a person to be mutually agreed upon, or failing arrangement of some person appointed by the London Chamber of Commerce and Industry and the City Corporation in accordance with, and subject to the provisions of the Arbitration Act 1934 or any statutory modifications or re-enactment thereof.

11 LOSS OR DAMAGE IN TRANSIT

Where the price includes delivery other than at our works we will repair or at our option replace free of charge within a reasonable time all goods lost or damaged in transit, provided we are given written notice of such loss or damage within such time as will enable us to comply with the carriers conditions of carriage or where delivery is made by our own transport within seven days (exclusive of Public Holidays) after receipt of the Advice Note. If so requested by you prior to the despatch of the goods we will notify you of the name and address of the carrier (if any) and any time limit laid down by such carriers conditions of carriage.

12 GOVERNING LAW

The contract shall be governed by English Law.

NOTE: The Company's prices are calculated on the basis that the above Conditions will apply. Customers requiring prices to be quoted on a different basis should inform the Company. Information regarding any of our components that bears reference to the Health and Safety at Work Act 1974 will be available upon request.

Notes

Notes

BONEHAM®

Boneham and Turner Ltd
/ Precision Engineered Solutions

Oddicroft Industrial Estate / Oddicroft Lane
Sutton in Ashfield / Nottinghamshire / NG17 5FS
Tel: +44 (0)1623 445 450 / Fax: +44 (0)1623 445 451
sales@boneham.co.uk / **www.boneham.co.uk**

Northwest Aerospace Alliance

MADE IN THE MIDLANDS

Composites UK Member Company

bsi. AS/EN 9100 Series Aviation, Space and Defense
FM 682749