

FORKARDT

INTERNATIONAL



EM + D
PRECISION MANDRELS



Forkardt mandrels and multi-blade clamping precision that comes from

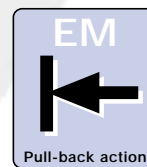
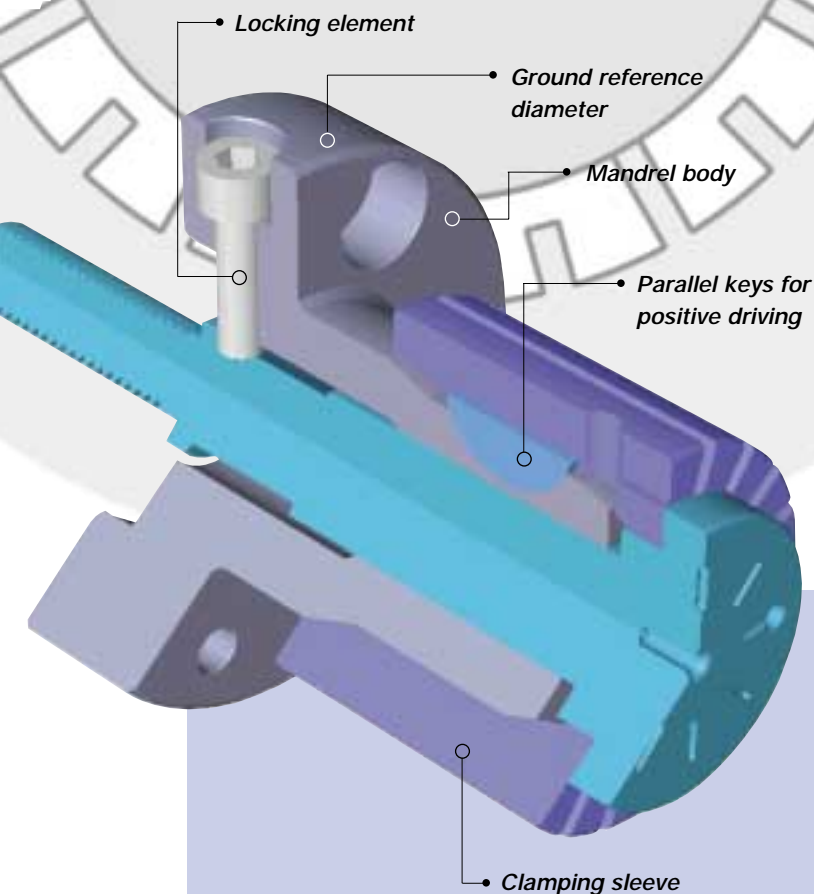
Mandrel EM

Flexibility with interchangeable clamping sleeves

The clamping sleeves are interchangeable modular units requiring no re-adjustment and can be ground by you.

With the double conical expansion of the clamping sleeves by 0.8 mm, a perfect clamping geometry is obtained.

The repeat accuracy is in the range of 0.01 mm. Special clamping sleeves are also available for clamping profiled, internally toothed, stepped or conical workpieces.



Highlights of the EM series

- Expansion of mandrels of 0.8 mm
- Suitable for automatic loading
- Repeat clamping accuracy less than 0.012 mm.
- Sealing of sleeve slots bonding available as standard.
- Stroke limitation for easy and safe handling

Technical data from page 4

de mandrels om inside.

Multi-blade mandrel D

Wide clamping range with perfect clamping geometry for tight tolerances.

Flexible clamping of workpieces with diverse bore diameters with the same mandrel and high precision of 0.01 mm.

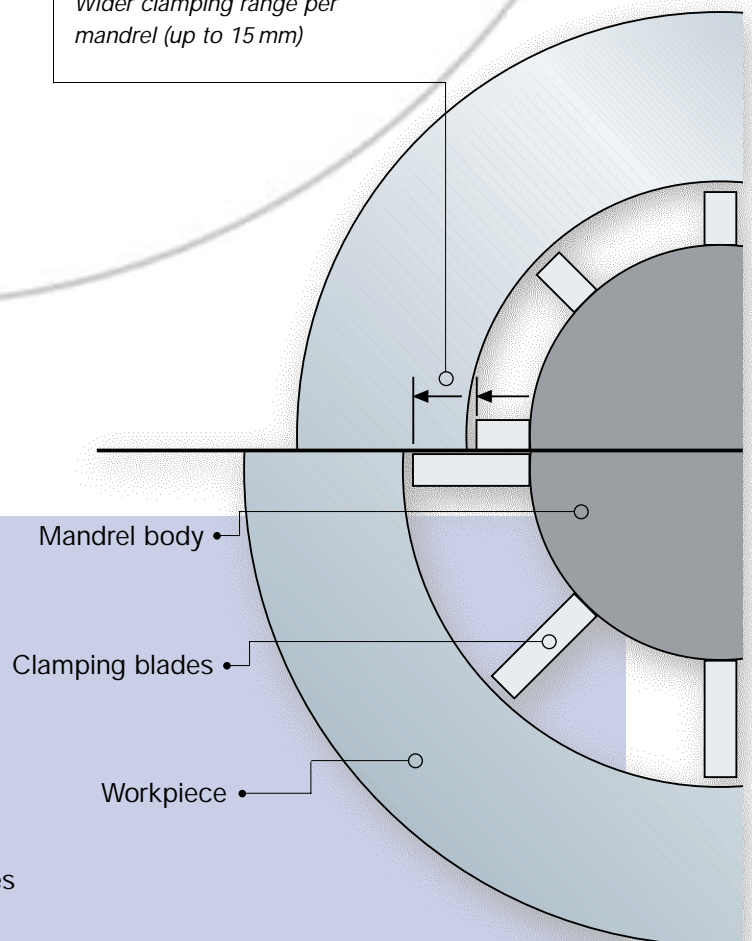
Unique wide clamping range offers considerable advantages over other conventional clamping systems. Fewer mandrels are required, shorter set-up time and greater flexibility.



Unique Forkardt advantage:
Wider clamping range per mandrel (up to 15 mm)

Highlights of the D series

- Wide clamping range
- Suitable for automatic loading
- Repeatability to 0.01 mm
- Axially fixed
- Uncompromising clamping geometry for narrow, consistent production tolerances



Technical data from page 8

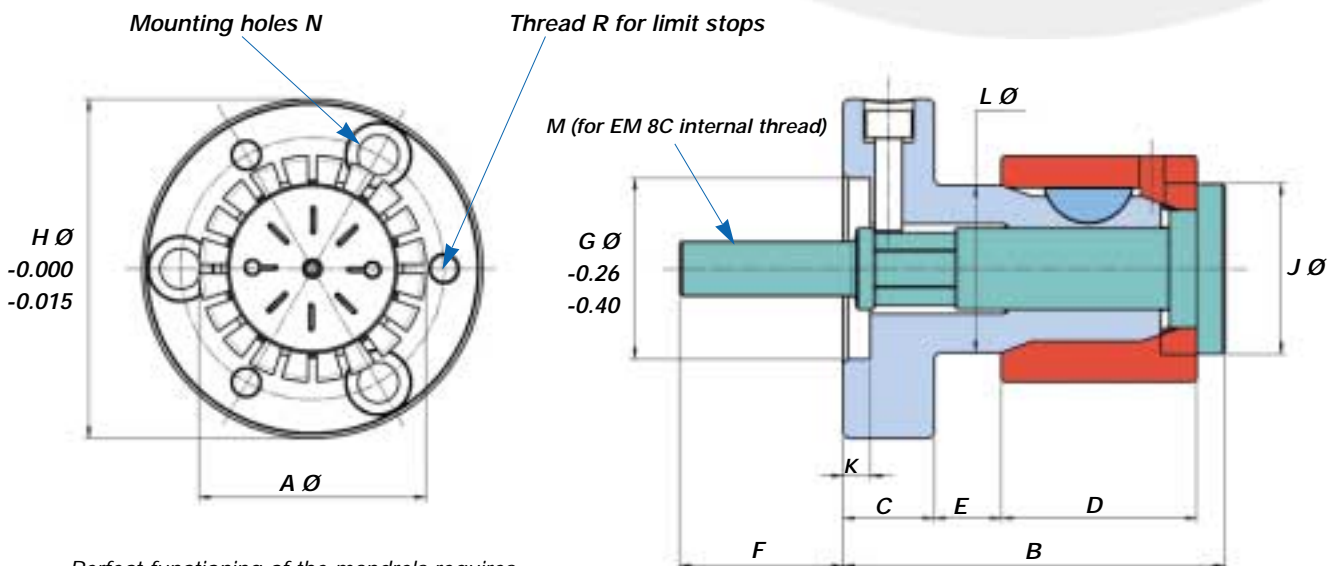
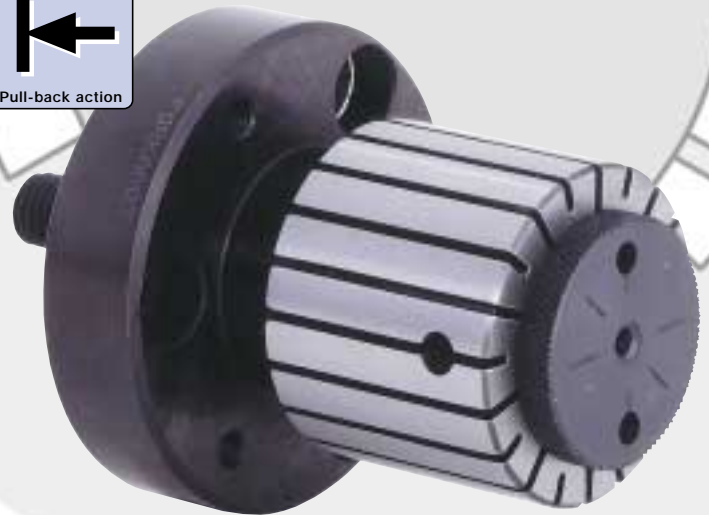
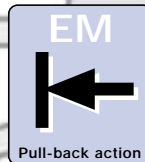
Conventional mandrels – with pr a broad applications spectrum.

Power-operated

Interchangeable clamping sleeves for maximum flexibility.

The power-operated flange variant can also be mounted on the machine spindle with an intermediate flange.

Naturally, interchangeable stops, rigid or moving can be tailored to your specific workpieces and supplied if required.



Perfect functioning of the mandrels requires pre-tensioned sleeves. The clamping cones of both the mandrel and the sleeve must have permanent contact.

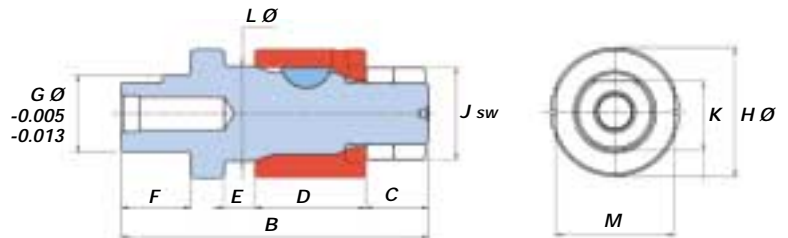
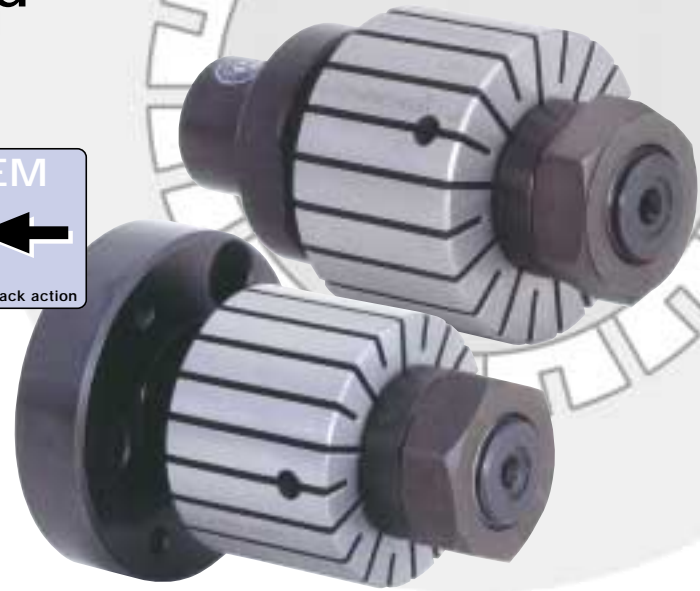
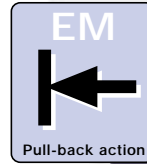
Type	Overall Clamping range		B	C	D		E	F	G	H	J	K	L	M	N		R		Fmax. (daN)	Order No.
	min.	max.			C1	C2									Fixing PC.D.	screw.	PC.D.	screw.		
3A	12.5	22.0	60	20	22.0	26.0	14.6	20	40	75	11.0	6	12.6	M4	58	M8	28	M4	500	90.800.210.1
2C	16.0	28.0	66	20	27.0	32.0	15.0	22	40	75	15.0	6	14.1	M8	58	M8	28	M4	1000	90.800.215.1
1C	22.0	40.0	72	20	32.0	38.0	15.5	30	40	75	20.0	6	20.7	M8	58	M8	58	M6	1200	90.800.221.1
18C	28.5	51.0	79	20	38.0	45.0	15.3	31	40	75	26.5	6	26.3	M10	58	M8	58	M6	1800	90.800.227.1
4C	41.0	73.5	84	20	43.0	50.0	14.8	36	40	75	37.5	6	37.0	M12	58	M8	58	M6	2300	90.800.234.1
5C	63.5	89.0	109	25	51.0	60.0	25.3	36	60	120	55.0	6	57.3	M20	94	M10	94	M8	2800	90.800.241.1
6C	76.2	102.0	118	25	57.0	69.0	24.7	37	60	120	74.5	6	71.1	M20	94	M10	94	M8	3200	90.800.248.1
7C	89.0	143.0	133	30	63.5	78.5	25.2	47	100	180	86.5	6	84.1	M24	150	M12	150	M10	3700	90.800.253.1
8C	130.0	178.0	153	30	79.5	99.5	24.6	22	100	180	124.0	6	123.0	M36	150	M12	150	M10	5500	90.800.259.1

Ordering example: Mandrel EM-1C, Nr. 90.800.221.1, power operated

oven technology and

Hand-operated

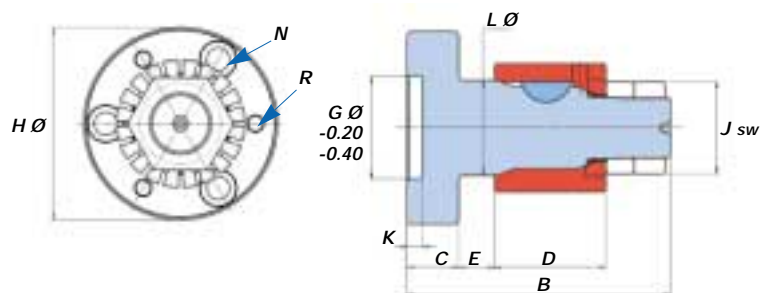
A flexible, cost effective and surprisingly efficient alternative. Hand-operated mandrels are used mainly for small series production or as test mandrels. The dimension "G" is tolerated as a size of fit for precise flange mounting. The flange-less version is normally mounted between two 60° centres. Limit stops can be mounted on the diameter "L".



Between centres

Type	Clamping range		B	C	D		E	F	G	H	J sw	K	L	M	Order No.
	min.	max.			C 1	C 2									
3A	12.5	22.0	77	16.0	22.0	26.0	10.0	20	20	26.0	10	18	9.5	22	90.811.110.1
2C	16.0	28.0	83	17.0	27.0	32.0	9.0	20	20	26.0	13	18	14.1	22	90.811.115.1
1C	22.0	40.0	99	18.5	32.0	38.0	10.5	27	30	40.0	19	27	20.7	26	90.821.121.1
18C	28.5	51.0	107	20.8	38.0	45.0	10.2	27	30	40.0	24	27	26.3	26	90.821.127.1
4C	41.0	73.5	120	27.0	43.0	50.0	10.0	27	30	50.0	36	27	37.0	46	90.821.134.1
5C	63.5	89.0	145	33.0	51.0	60.0	26.0	35	40	57.3	55	35	57.3	50	90.831.141.1
6C	76.2	102.0	155	37.0	57.0	69.0	26.0	35	50	71.1	65	45	71.1	60	90.841.148.1
7C	89.0	143.0	205	47.5	63.5	78.5	34.0	50	60	84.1	Ø 85	55	84.1	70	90.851.153.1
8C	130.0	178.0	235	50.5	79.5	99.5	55.0	50	80	123.0	Ø 124	73	123.1	105	90.861.159.1

Ordering example: Mandrel EM-6C, 90.841.148.1, hand-operated, flange-less



Flange version

Type	Clamping range		B	C	D		E	G	H	J sw	K	L	N Fixing		R Stops		Order No.
	min.	max.			C 1	C 2							PC.D.	screw	PC.D.	screw	
3A	12.5	22.0	73	20	22.0	26.0	15.0	40	75	10	6	12.6	58	M8	28	M4	90.800.110.1
2C	16.0	28.0	79	20	27.0	32.0	15.0	40	75	13	6	14.1	58	M8	28	M4	90.800.115.1
1C	22.0	40.0	86	20	32.0	38.0	15.5	40	75	19	6	20.7	58	M8	58	M6	90.800.121.1
18C	28.5	51.0	94	20	38.0	45.0	15.2	40	75	24	6	26.3	58	M8	58	M6	90.800.127.1
4C	41.0	73.5	105	20	43.0	50.0	15.0	40	75	36	6	37.0	58	M8	58	M6	90.800.134.1
5C	63.5	89.0	134	25	51.0	60.0	25.0	60	120	55	6	57.3	94	M10	94	M8	90.800.141.1
6C	76.2	102.0	144	25	57.0	69.0	25.0	60	120	65	6	71.1	94	M10	94	M8	90.800.148.1
7C	89.0	143.0	166	30	63.5	78.5	25.0	100	180	Ø 85	6	84.1	150	M12	150	M10	90.800.153.1
8C	130.0	178.0	185	30	79.5	99.5	25.0	100	180	Ø 124	6	123.0	150	M12	150	M10	90.800.159.1

Ordering example: Mandrel EM-6C, 90.800.127.1, hand-operated

Modular clamping sleeve range flexible chucking.

• Standard clamping sleeves

All the clamping sleeves shown can easily be used on all standard mandrels. The clamping sleeves are stocked in a prefabricated condition and are finish-ground when ordered. Thus facilitating speedy delivery. For this reason the nominal size of the workpiece bore with tolerance zone must be clearly stated when ordering.



In-house finish-grinding of clamping sleeves:

The easiest way to finish-grind a clamping sleeve is on a hand-operated mandrel.

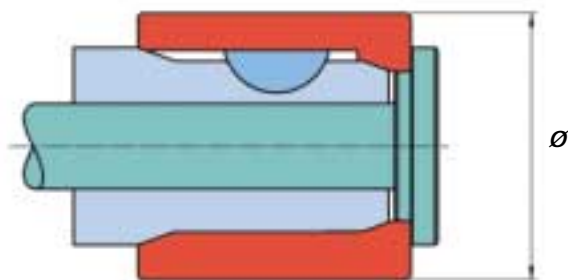
However, finish-grinding can also take place on the associated power-operated mandrel.

In this case, the clamping sleeve must be pre-tensioned with a hexagon nut and tie-bolt as shown in the operating instructions and finish-ground.

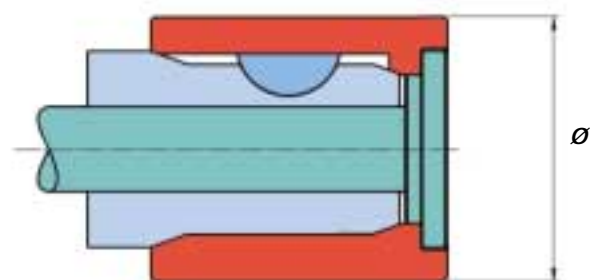
Recommended pre-tension for sizes:

3A/2C/1C/18C	0.13 mm
4C/5C/6C	0.26 mm
7C/8C	0.39 mm

Standard



With recessed draw bar head (2)



Type	Clamping range		Length
	min.	max.	
3 A1	12.5	16.0	22.0
2 C1	16.0	22.0	27.0
1 C1	22.0	28.5	32.0
18 C1	28.5	41.0	38.0
4 C1	41.0	63.5	43.0
5 C1	63.5	76.2	51.0
6 C1	76.2	89.0	57.0
7 C1	89.0	130.0	63.5
8 C1	130.0	178.0	80.0

Ordering example:

Clamping sleeve EM-3A2,
slot bonding,
clamping diameter
20.0 mm/+0,003/-0,01

Type	Clamping range		Length
	min.	max.	
3 A2	16.5	22.0	26.0
2 C2	22.0	28.0	32.0
1 C2	28.0	40.0	38.0
18 C2	40.0	51.0	45.0
4 C2	51.0	73.5	50.0
5 C2	73.5	89.0	60.0
6 C2	89.0	102.0	69.0
7 C2	101.0	143.0	78.5
8 C2	143.0	178.0	99.5

for fast and

Special clamping sleeves

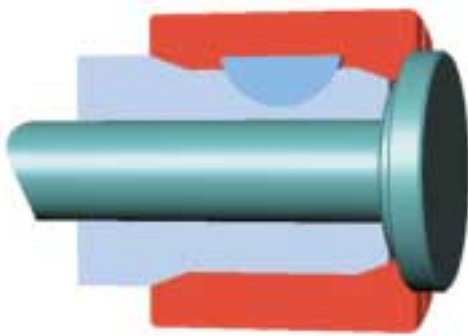
Particularly difficult problems can be solved easily with specially shaped clamping sleeves. For example, extended or profiled clamping sleeves are available with internal toothing or splines for clamping in the base or pitch circle. Also available are segmented clamping sleeves for extremely high transmission forces.

Special problem solutions are readily available for your workpieces.

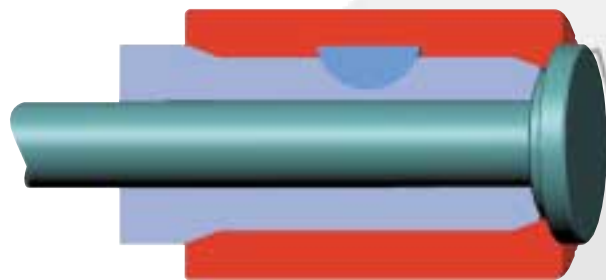


A few common examples are shown below:

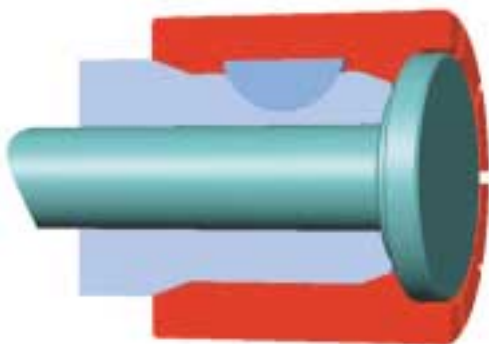
Shortened standard type



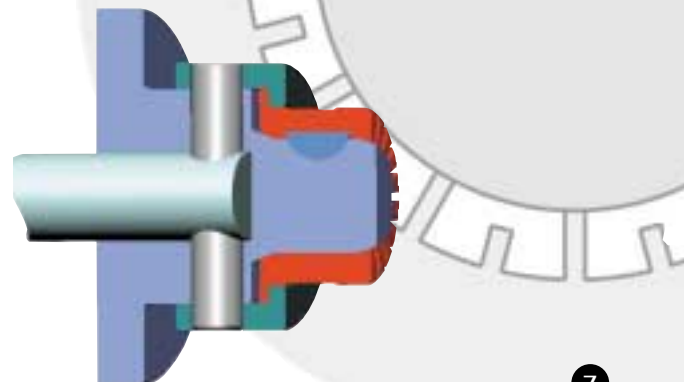
Extended standard type



Shortened type with recessed draw bar head



External actuation of the clamping sleeve type C9



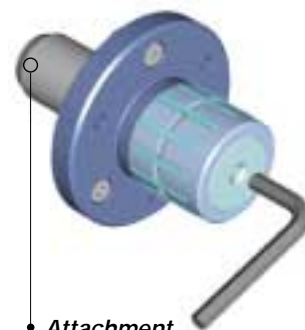
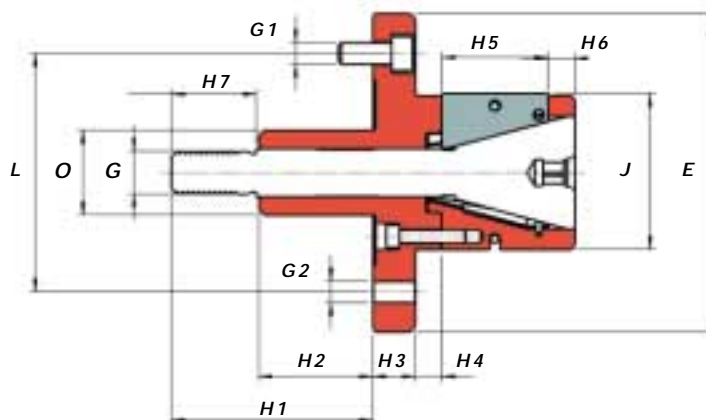
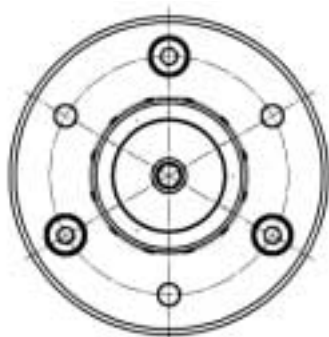
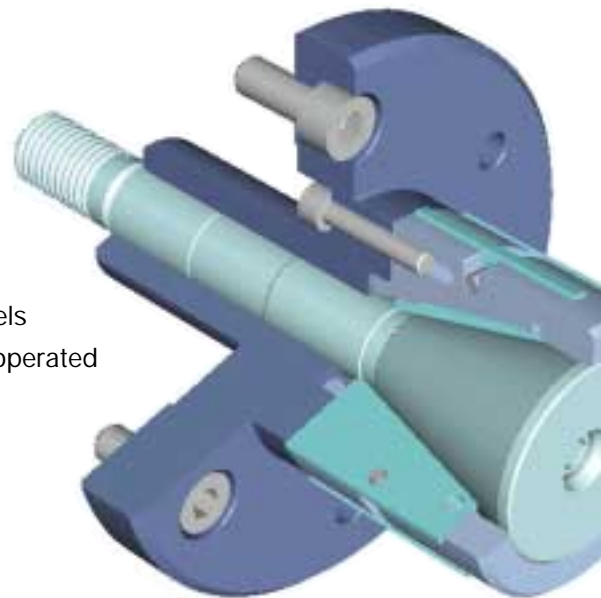
Multi-blade mandrels with highly FORKARDT technology.

Short multi-blade mandrel D-S For short workpieces

The clamping blades are all moved together, very precisely radially, so that a concentricity of 0.01 mm maximum is provided over the entire clamping range. To generate the axial force, pneumatic or hydraulic cylinders can be used. When equipped with the appropriate attachment



these mandrels can also be operated manually.



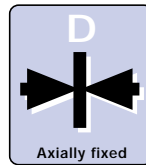
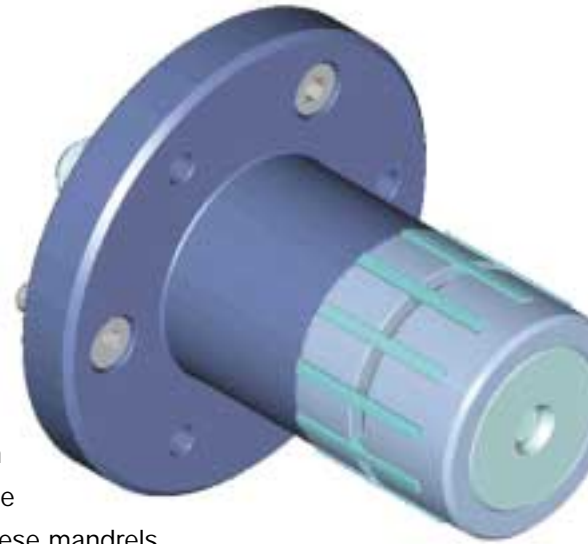
Attachment for manual actuation

Short version

Type designation	J Clamping range	Number of clamping blades	H 1 min.-max.	H 2	H 4	Actuation F axial max. (daN)	Clamping power F sp max. (daN)	Also for long version				
								H 3	H 5	H 6	H 7	E h 6
D 1-25	25-28	8	32.5-39	19	4	250	500	12	16	4	13	80
D 1-28	28-31	8	32.5-39	19	4	250	500	12	16	4	13	80
D 1-31	31-34	8	32.5-39	19	4	250	500	12	16	4	13	80
D 1-34	34-37	8	44.5-51	28	5	360	720	12	22	5	16	80
D 1-37	37-40	8	44.5-51	28	5	360	720	12	22	5	16	80
D 2-40	40-43	10	64-70.5	38	6	1000	2000	16	26	6	25	120
D 2-43	43-46	10	64-70.5	38	6	1000	2000	16	26	6	25	120
D 2-46	46-49	10	64-70.5	38	6	1000	2000	16	26	6	25	120
D 2-49	49-52	10	64-70.5	38	6	1000	2000	16	26	6	25	120
D 2-52	52-55	10	64-70.5	38	6	1000	2000	16	26	6	25	120
D 2-55	55-58	10	64-70.5	38	6	1000	2000	16	26	6	25	120
D 2-58	58-61	10	64-70.5	38	6	1000	2000	16	26	6	25	120
D 2-60	60-65	12	76-87	43	10	1800	3600	16	40	10	32	120
D 2-65	65-70	12	76-87	43	10	1800	3600	16	40	10	32	120
D 2-70	70-75	12	76-87	43	10	1800	3600	16	40	10	32	120
D 2-75	75-80	12	76-87	43	10	1800	3600	16	40	10	32	120
D 2-80	80-88	14	96-112.5	54	15	2800	5600	18	60	15	41	165
D 2-88	88-96	14	96-112.5	54	15	2800	5600	18	60	15	41	165
D 2-96	96-104	14	96-112.5	54	15	2800	5600	18	60	15	41	165
D 2-104	104-112	14	96-112.5	54	15	2800	5600	18	60	15	41	165
D 2-112	112-120	14	96-112.5	54	15	2800	5600	18	60	15	41	165
D 2-120	120-128	14	96-112.5	54	15	2800	5600	18	60	15	41	165

Ordering example: Multi-blade mandrel FORKARDT D 2-60 with attachment for hand operation

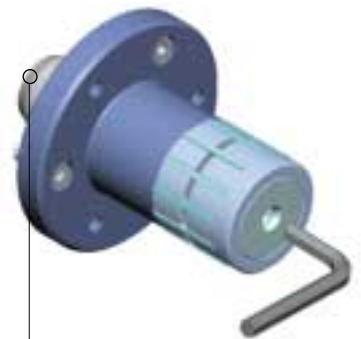
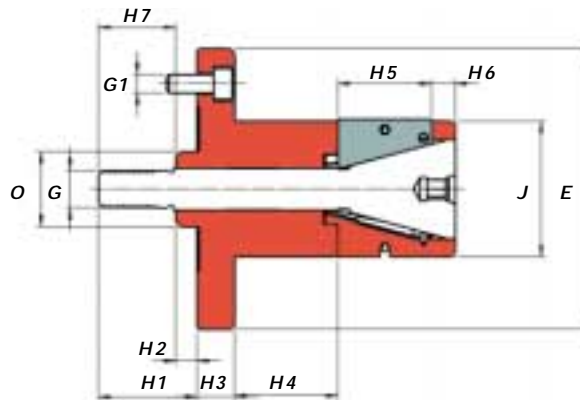
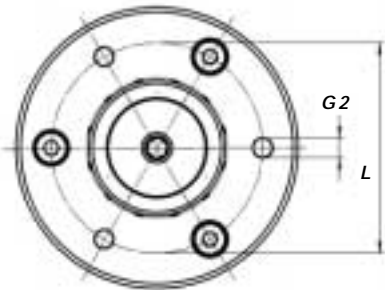
advanced



• **Long multi-blade mandrel D-L**
For long workpieces

The clamping blades are all moved together, very precisely radially and so provide a perfect clamping geometry over the entire clamping range with a concentricity of 0.01 mm maximum. To generate the axial force, pneumatic or hydraulic cylinders can be used.

When equipped with the appropriate attachment these mandrels can also be operated manually.



• Attachment for manual actuation

Long version

Type designation	J Clamping range	Number of clamping blades	H 1 min.-max.	H 2	H 4	Actuation F axial max. (daN)	Clamping power F sp max. (daN)	Also for short version				
								G	L	G 1	G 2	0 h 6
D 1-25 L	25-28	8	21.5-28	8	15	250	500	M6	65	M8	M5	12
D 1-28 L	28-31	8	21.5-28	8	15	250	500	M6	65	M8	M5	12
D 1-31 L	31-34	8	21.5-28	8	15	250	500	M6	65	M8	M5	12
D 1-34 L	34-37	8	24.5-31	8	25	360	720	M8	65	M8	M5	16
D 1-37 L	37-40	8	24.5-31	8	25	360	720	M8	65	M8	M5	16
D 2-40 L	40-43	10	35-41.5	9	35	1000	2000	M12	90	M8	M6	22
D 2-43 L	43-46	10	35-41.5	9	35	1000	2000	M12	90	M8	M6	22
D 2-46 L	46-49	10	35-41.5	9	35	1000	2000	M12	90	M8	M6	22
D 2-49 L	49-52	10	35-41.5	9	35	1000	2000	M12	90	M8	M6	22
D 2-52 L	52-55	10	35-41.5	9	35	1000	2000	M12	90	M8	M6	22
D 2-55 L	55-58	10	35-41.5	9	35	1000	2000	M12	90	M8	M6	22
D 2-58 L	58-61	10	35-41.5	9	35	1000	2000	M12	90	M8	M6	22
D 2-60 L	60-65	12	42-53	9	44	1800	3600	M16	90	M8	M8	32
D 2-65 L	65-70	12	42-53	9	44	1800	3600	M16	90	M8	M8	32
D 2-70 L	70-75	12	42-53	9	44	1800	3600	M16	90	M8	M8	32
D 2-75 L	75-80	12	42-53	9	44	1800	3600	M16	90	M8	M8	32
D 2-80 L	80-88	14	51-67.5	9	60	2800	5600	M20	135	M10	M10	40
D 2-88 L	88-96	14	51-67.5	9	60	2800	5600	M20	135	M10	M10	40
D 2-96 L	96-104	14	51-67.5	9	60	2800	5600	M20	135	M10	M10	40
D 2-104 L	104-112	14	51-67.5	9	60	2800	5600	M20	135	M10	M10	40
D 2-112 L	112-120	14	51-67.5	9	60	2800	5600	M20	135	M10	M10	40
D 2-120 L	120-128	14	51-67.5	9	60	2800	5600	M20	135	M10	M10	40

Ordering example: Multi-blade mandrel FORKARDT D 2-60 L

Special mandrels designed to solve special problems.

Special problems require special solutions.

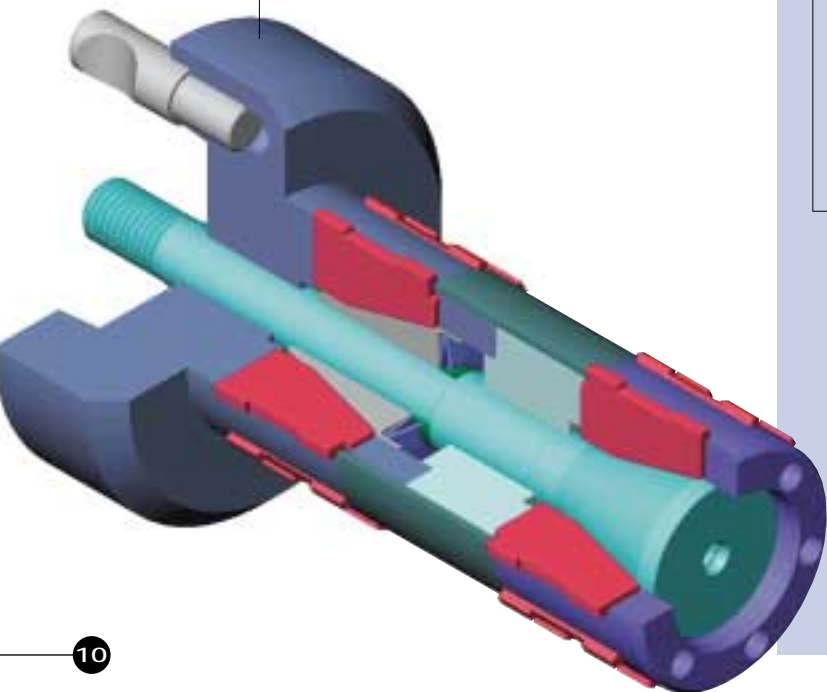
FORKARDT has the experience and the technology to deliver workable cost effective solutions. Shown below are just a few examples of the many successful solutions which have been developed recently:

Example 1:

Multi-blade double mandrel for long workpieces

Both clamping groups each with 12 blades clamp concentric and independent of each other, so that workpieces can be adjusted to various diameters.

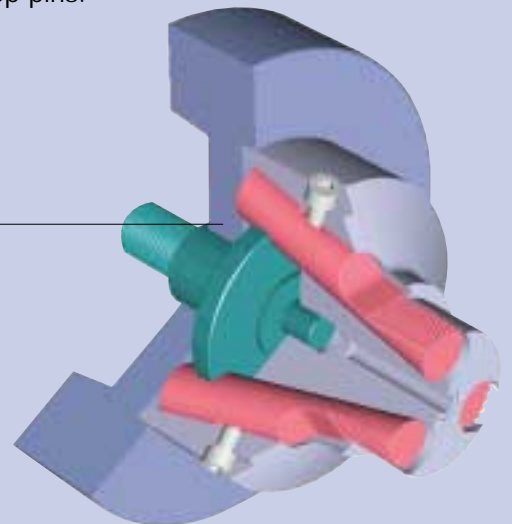
When the mandrel piston is moved to the left, the right clamping point acts. The left clamping point, spring pre-loaded, aligns the workpiece in the second plane and increases the clamping power necessary for driving purposes.

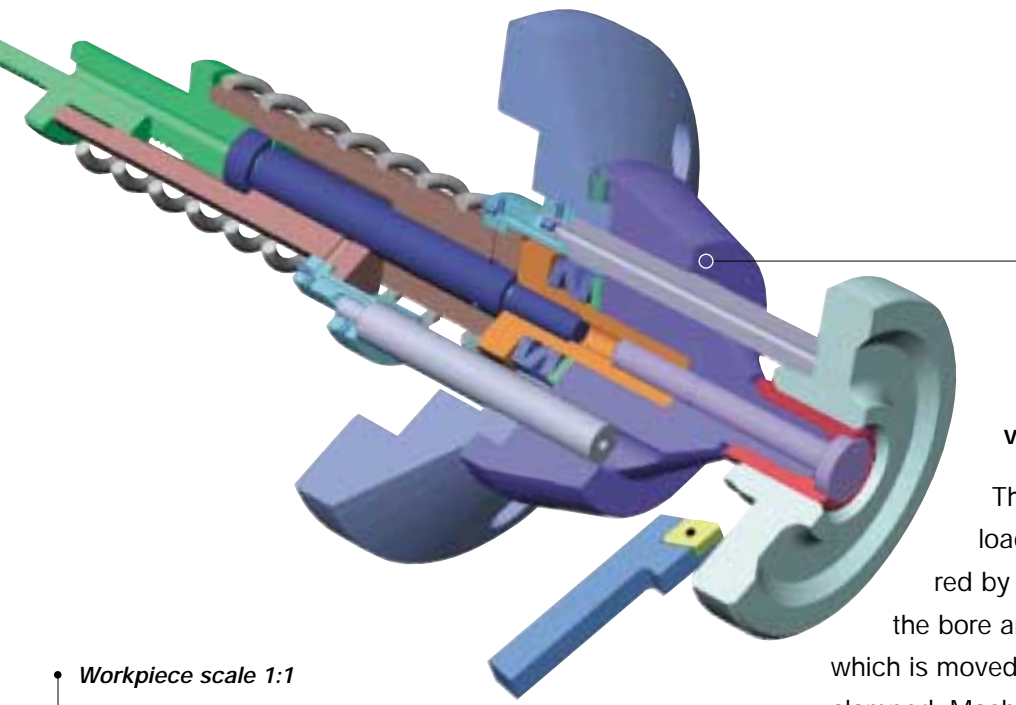


Example 2:

Mandrel for holding un-machined workpieces, DLU series

The jaws of the mandrel operating with tensile force for forged parts (sleeve heads) with a tapered bore slide in the inclined guides of the mandrel body and are supported towards the front. The jaws draw the workpiece back against the three simultaneously supporting stop pins.

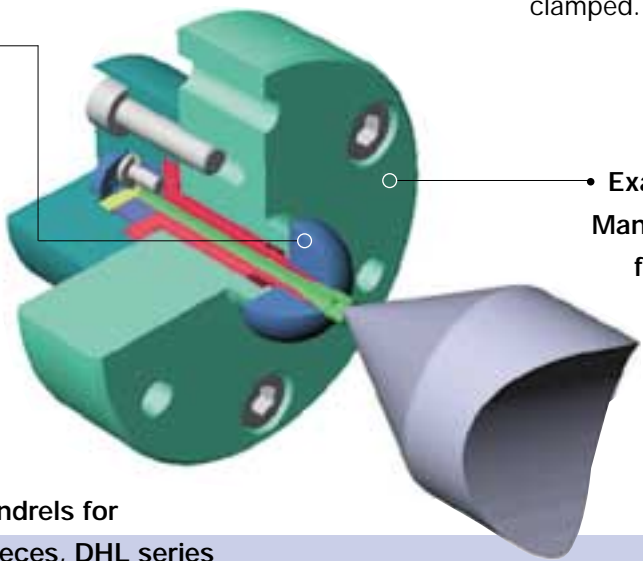
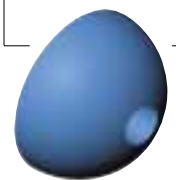




• **Example 4:**
Mandrel type EM/special version, with retractable stop

The workpiece "driving wheel" is loaded automatically and monitored by air pressure. It is clamped in the bore and drawn towards the stop, which is moved back when the workpiece is clamped. Machining takes place on all sides.

• *Workpiece scale 1:1*

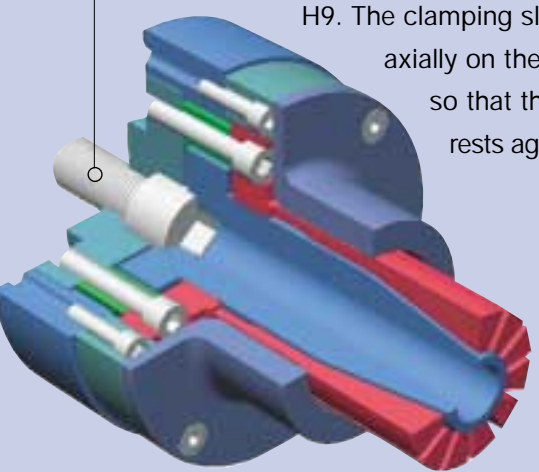


• **Example 5:**
Mandrel for small parts with a diameter from about 5 mm.

The workpiece is clamped via the slotted sleeve, actuated by the axial pressure of the tailstock centre.

• **Example 3:**
Expanding mandrels for narrow workpieces, DHL series

Expanding mandrels are used preferably for workpieces with bores in a quality from H8 to H9. The clamping sleeve is fitted axially on the mandrel, so that the workpiece rests against the stop.



Show us your workpiece - FORKARDT will develop a tailored solution to meet your requirements

FORKARDT has for many years been developing special, high-quality mandrels, characterised by precision, simplicity and reliability.

Show us your workpiece and we will be happy to provide you with a cost-effective solution, exactly tailored to your needs.

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