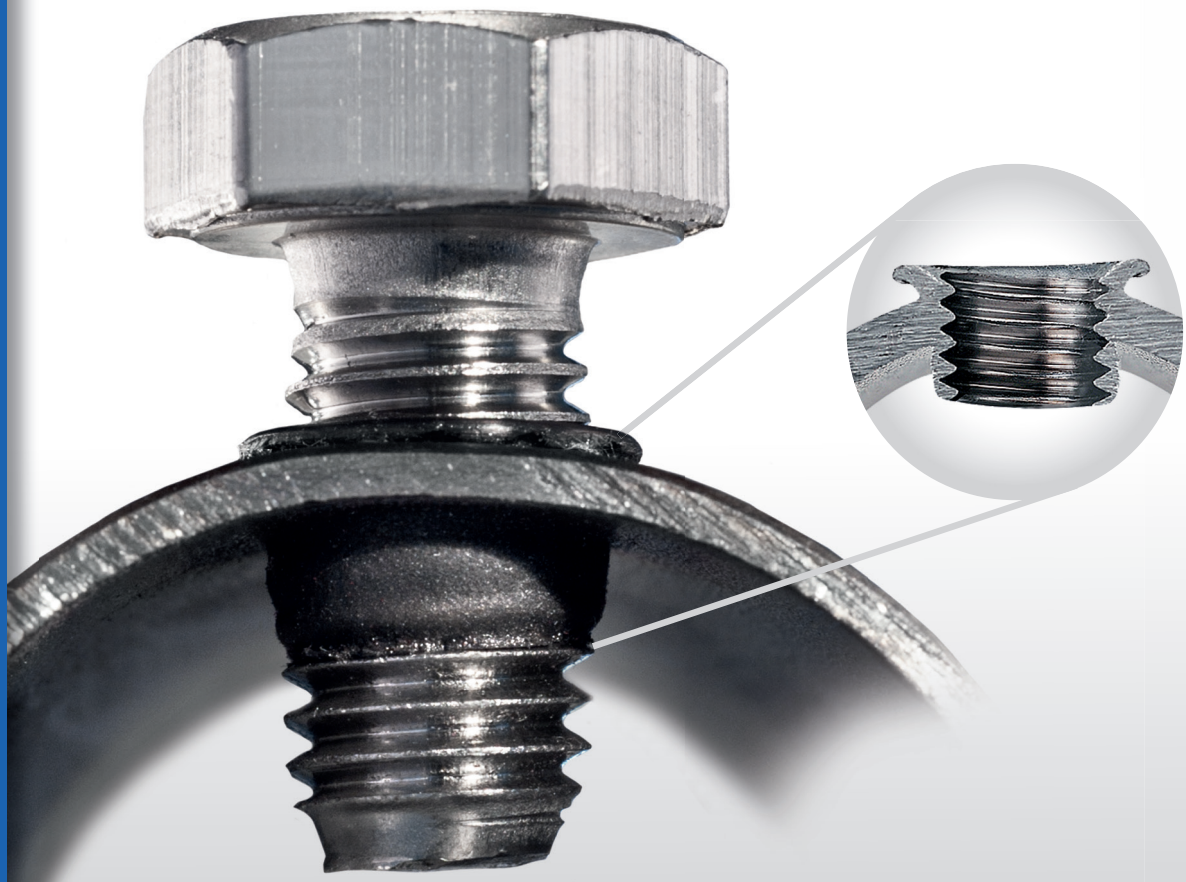
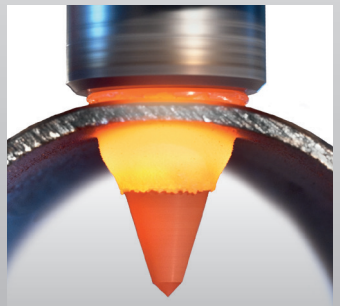
Guidebook

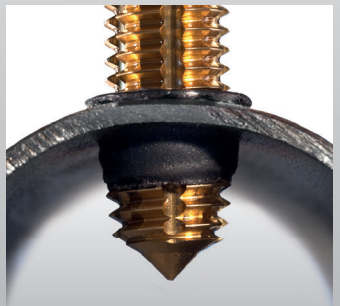
THERMDRILL®

Fastening Technology – Made in Germany

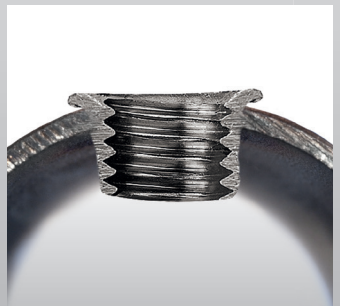




1. Step
Thermal Drilling



2. Step
Thread Forming



Result
Threaded Bushing

MADE IN GERMANY

Guidebook for secure screw connections in pipe, profile and sheet metal

1 Introduction

The need for a resource-conserving production in connection with the development of ecological products has not been an issue in the metalworking industry until the discussion about climate warming

It is always about the efficient use of tools and processes that make work easier and the products better, cheaper, safer and more sustainable.

This trend has been influenced the fastening technologies for many years and created a large variety of innovative products and processes.

As a manufacturer of tools, Ontool has been following this trend for more than a decade and has made a name for itself as a provider of high-performance tools for the production of cost-effective, stable threaded bushings for secure screw connections in thin-walled metallic materials.

Thermdrill hard metal tools are developed in Germany to eliminate numerous disadvantages and safety risks that inherently come with traditional joining techniques such as rivet and welding nuts. In addition, the investment costs are very low, since the existing machine park (pillar drilling machine, milling machine, CNC center) usually can be used.

Within this guide you will find all important information about the process and requirements for the production of detachable screw connections. It is intended as a quick reference for users to discover this amazing fastening technology in order to produce quickly, cost-effectively and with high quality.

I hope you enjoy reading

Oliver Waldmann, Managing Director of Ontool GmbH

2 Safety risk due to wobbly rivet nuts

Every metal worker knows the problem that comes along with rivet nuts. Even if these kind of attachments are fixed carefully there is a high risk that they can get wobbly or loose after a while especially when it is used for connections with dynamic load or vibrations

These type of connections are not only time consuming but also cause high costs for rejects or complaints by customers.

Fig. shows a rivet nut that become loose after load

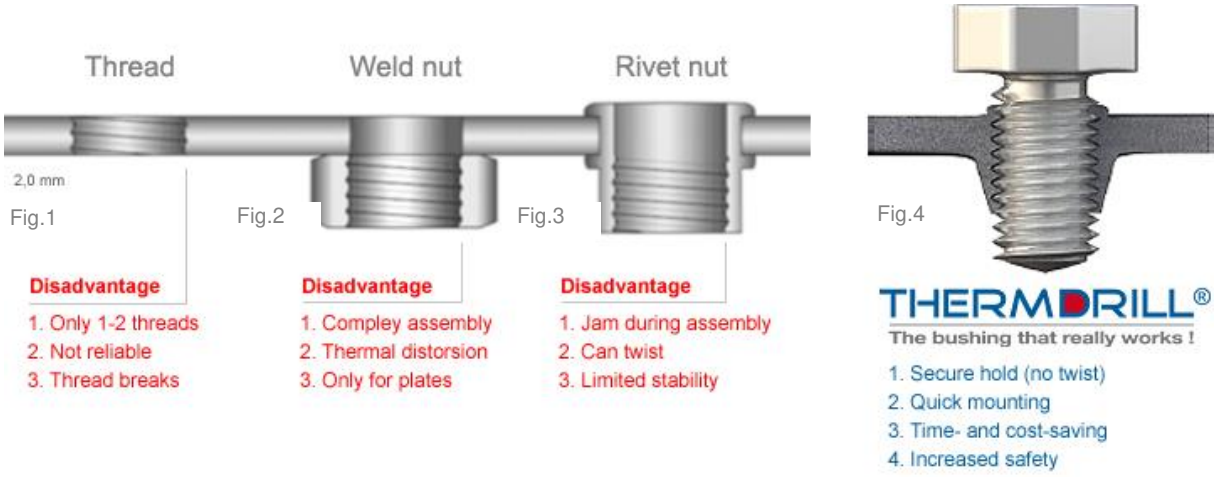
The reason for this is that the rivet nut is just crimped … and therefore represent a weak point for any screw connection.

<u>Disadvantages and consequences</u>:

- **Risk of rework** due to assenbly errors …
  Rivet nut needs to be drilled out and crimped again
- **Unsafe connections** and claims for damages
- **High costs per piece** due to costly installation

3 Problems of traditional joining techniques?

Considering the problem of screw connections at low wall thicknesses, it is quickly clear that only 1-2 threads can be inserted in thin-walled tubes, profiles or metal sheets (Fig.1). This is too little for a loadable thread.



In order to increase the number of threads respectively increase the loading capacity welding nuts (Fig.2) or rivet nuts (Fig.3) are usually used.

Especially with round tubes the problem of rivet nuts shows-up very clearly. As by the curvature of the tube not only the contact surface is reduced but also the holding torque of the rivet nut.

Fig. shows a rivet nut that is crimped to a stainless steel tube with 2,0 mm wall thickness. The yellow arrow shows the small contact area which reduces the holding torque

With the Thermdrill procedure the threaded bushing (Fig.4) is formed from the existing material without the need of inserts.
This guarantees a 100% twist-proof and wobble-free screw connections, which is reliable also with extreme loads.

4 The idea. Reliable bushing made by friction heat

The idea to produce wobble-free bushings from the existing material is actually quite simple and is based on the generation of friction heat.

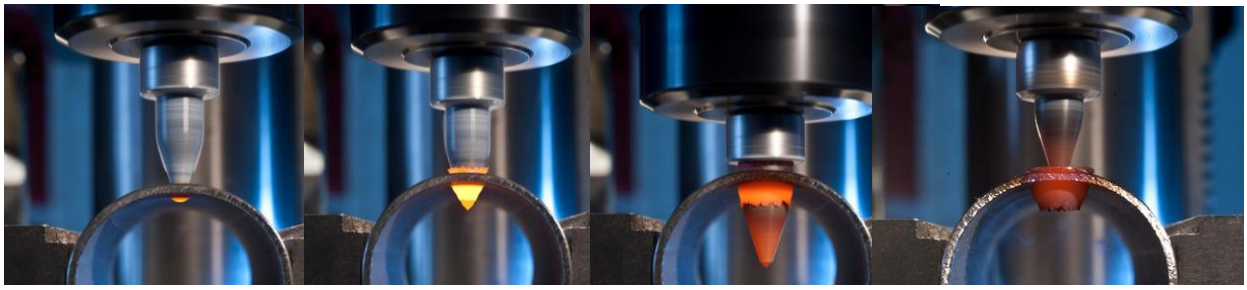
When the Thermdrill is touching the surface of the part contact pressure and rotational speed generates so much friction heat that the material gets soft and deformable. By pushing the Thermdrill through the material a bushing is formed from the displaced material that is three times more than the original material thickness and gives now enough space for the threads.

Fig. shows the first step to produce a bushing by thermal drilling.

5 The Thermdrill process

1. Step
Thermal Drilling – chipless drilling into almost all types of metal

Through the rotation of the thermal drill and pressing it against the working piece it generates that much friction heat that the surrounding material get immediately soft to form a bushing.



Starting	Heating-up	Forming	Final
• Gentle touch on the material surface auf das Material • Centering by the tip • Maximum axial force	• Flow of the material upwards (25%) and downwards (75%) of the displaced volume	• Widening of the bushing to the final core diameter • Forming the collar (FORM-type) or cutting (CUT-type) • Maximum torque of the drilling machine	• Quick back out of the bushing • Cooling down of the thermal drill until it has its natural color again After 2-3 sec. one can start drilling again !

*Suitable metals:

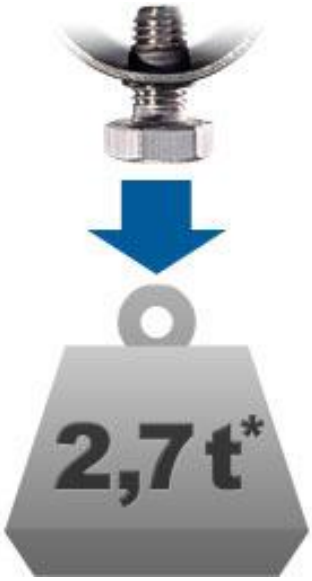
- Aluminum
- Brass
- Copper
- Mild steel
- Stainless steel
- Special alloys

2. Step
Thread forming – High pull-out strength guaranteed

While thread forming the threads are compressed by a chipless process and not cut as usual.

Fig. shows the chipless process of thread forming

Fig. shows the ready to use screw connection with a THERMDRILL bushing



*Pull-out strength for M8 in 2,0 mm wall thickness

Threads almost as forged

The material is cold formed and compacted as forging without destroying the natural grain.

The higher edge solidification of the formed thread guarantees a higher pull-out strength under static and particularly under dynamic load.

FORMED THREAD

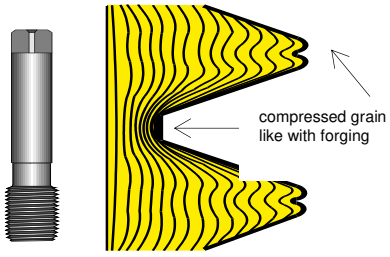


Fig. shows the grain-flow of a formed thread

CUT THREAD

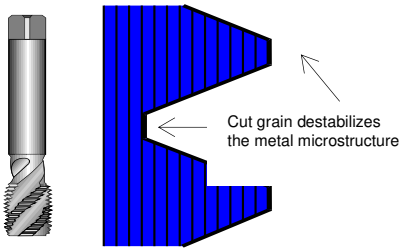


Fig. shows the grain-flow of a cut thread

6 The result. High quality threaded bushings

Made out of one piece. THERMDRILL threaded bushings

100% torque-resistant and resistant to tensile and compressive load thermal drilled threaded bushings are more than an equivalent alternative to the rivet nut.

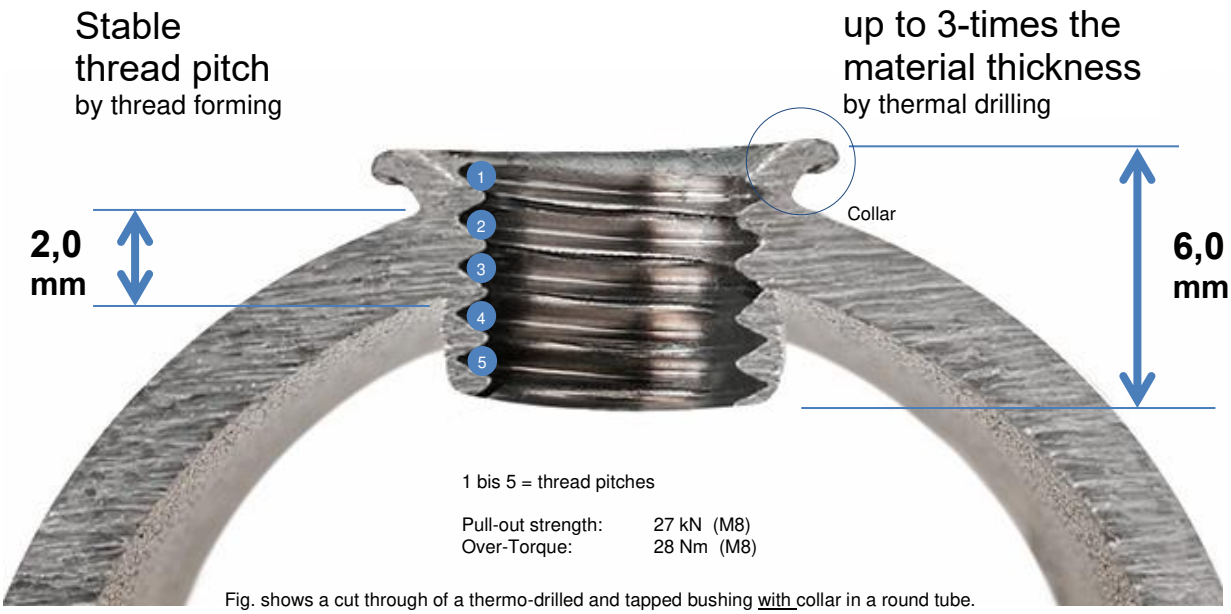


Fig. shows a cut through of a thermo-drilled and tapped bushing with collar in a round tube.

Your advantages in terms of quality and durability:

- **100% twist-free**
  No more wobble, loosening or twist like with rivet nuts
- **Reduction of rejects**
  Saves annoying drilling-out of rivets and avoids claims
- **Increases the safety of your products**
  through extreme pull-out strength t even with dynamic load, vibrations

Other special features:

- Range of use between 1,0 mm to max. 10 mm wall thickness (thread M20)
- Just one tool for aluminum, brass, copper, steel and stainless steel
- Can be applied on CNC machines

7 Cost saving

When doing a calculation to quote a complex part the cost of screw connections are generally not calculated or only with a percentage surcharge on the total costs. Due to the low individual price of the rivet and welding nuts, many users are usually not aware of how much you really pay for such joining technologies.

If, however, the piece costs are compared to the year the screw connection could become an enormous cost factor depending on the application regardless possible costs for rework and rejects. By the use of alternative technologies such as Thermdrill® one can reduce these costs by 70% without a big effort.

The following table shows this on a calculation example:

	Rivet nut 	THERMDRILL® The bushing that really works ! 	up tp 70% cost savings
Material costs	1.000 € 5.000 x 0,20 € f. alu. rivet nut	105 € 1 x Tool-Set M8 short-form	898 €
Labor costs 45 €/h	1.000 € 16 Sec x 5.000 x 45 €/h	500 € 8 Sec x 5.000 x 45 €/h	500 €
Total costs	**2.000 €**	**605 €**	**1.395 €**

<u>Your economical benefits at a glance</u>:

- **Increased productivity**
  Min. 50% faster than with rivet nuts
- **Reduction of production costs**
  Rivet or weld nuts are no longer necessary. Just 4-5 ct. per thermal drilled bushing*
- **Low cost of entry**
  Tools and basic equipment pay off at the first tool-set
- **Low maintenance costs**
  by longevity of the screw connection

8 Pull-out strength & Torque

Pull-out strength [kN] for Thermdrill threaded bushings

MILD STEEL (St37)

Wall-thickness [mm] Thread	1,0	1,5	2,0	3,0	4,0	5,0
M4	6 k		9			
M5	10 k	13 k	15			
M6		16 k	17	24		
M8			27	42	45	
M10				53	72	
M12				72	91	101
M16				97	105	141
M20				142	162	>200

STAINLESS STEEL (X5CrNi1810)

Wall-thickness [mm] Thread	1,0	1,5	2,0	3,0	4,0	5,0
M6		24				
M8		24	32	44		
M10			42	64		

ALUMINUM (AlMgSiO0,5)

Wall-thickness [mm] Thread	1,0	1,5	2,0	3,0	4,0	5,0
M6		3,8	5,6	9,5		
M8		5,4	9,2	11,4		
M10			11,0	14,6		

Torque [Nm] for Thermdrill threaded bushings

MILD STEEL (St37)

Wall-thickness [mm] Thread	1,0	1,5	2,0	3,0	4,0	5,0
M4	5		9			
M5	8	11	13			
M6		17	20	27		
M8			28	50	67	
M10				66	98	
M12				136	163	269
M16				197		

9 Thermdrill Selection Table

Thread	Core hole [mm]	FORM  For bushings with collar						CUT  For bushings without collar						Shaft-Ø
		Short			Long			Short			Long			
		max. Wall-thickness [mm]	Article-No.	Length Working Part [mm]	max. Wall-thickness [mm]	Article-No.	Length Working Part [mm]	max. Wall-thickness [mm]	Article-No.	Length Working Part [mm]	max. Wall-thickness [mm]	Article-No.	Length Working Part [mm]	[mm]
M3 x 0,5	2,7	**1,5**	27FS	6,4	**2,0**	27FL	7,6	**1,5**	27CS	6,4	**3,0**	27CL	7,6	6,0
M4 x 0,7	3,7	**1,5**	37FS	7,6	**2,5**	37FL	10,1	**2,0**	37CS	7,6	**4,0**	37CL	10,1	6,0
M5 x 0,8	4,5	**2,0**	45FS	9,1	**3,0**	45FL	12,0	**3,0**	45CS	9,1	**4,5**	45CL	12,0	6,0
M6 x 1,0	5,4	**2,0**	54FS	10,1	**3,5**	54FL	14,4	**3,0**	54CS	10,1	**5,0**	54CL	14,4	8,0
M8 x 1,25	7,4	**2,5**	74FS	13,5	**4,0**	74FL	18,2	**4,0**	74CS	13,5	**6,0**	74CL	18,2	8,0
M10 x 1,5	9,3	**2,5**	93FS	16,2	**4,5**	93FL	21,7	**4,0**	93CS	16,2	**6,5**	93CL	21,7	10,0
M12 x 1,75	11,0	**3,0**	110FS	19,3	**5,0**	110FL	25,8	**4,5**	110CS	19,3	**7,0**	110CL	25,8	12,0
M14 x 2,0	13,1	**3,0**	131FS	22,7	**5,0**	131FL	31,5	**4,5**	131CS	22,7	**7,0**	131CL	31,5	14,0
M16 x 2,0	14,9	**3,5**	149FS	26,2	**6,0**	149FL	35,7	**5,0**	149CS	26,2	**8,0**	149CL	35,7	16,0
M18 x 2,5	16,8	**3,5**	168FS	29,4	**6,0**	168FL	39,5	**5,0**	168CS	29,4	**8,0**	168CL	39,5	18,0
M20 x 2,5	18,8	**4,0**	188FS	33,1	**8,0**	188FL	43,4	**6,0**	188CS	33,1	**10,0**	188CL	43,4	18,0
G1/8“	9,3	**2,5**	93FS	16,2	**4,5**	93FL	21,7	**4,0**	93CS	16,2	**6,5**	93CL	21,7	10,0
G1/4“	12,5	**2,5**	125FS	21,3	**5,0**	125FL	26,4	**4,0**	125CS	21,3	**7,0**	125CL	26,4	14,0
G3/8“	16,0	**2,5**	160FS	27,0	**5,0**	160FL	31,0	**4,0**	160CS	27,0	**7,0**	160CL	31,0	16,0
G1/2“	20,0	**2,5**	200FS	36,3	**-**	-	-	**4,0**	200CS	36,3	**-**	-	-	18,0
G3/4“	25,5	**2,5**	255FS	43,6	**-**	-	-	**4,0**	254CS	43,6	**-**	-	-	20,0
G1“	32,1	**2,5**	321FS	52,3	**-**	-	-			52,3		-	-	20,0

10 Power data for your drilling unit

Thread	Rotational speed per material quality [RPM]						Thread forming [RPM]	Wall-thickness [mm]	Motor-capacity [kW]
	Mild steel		Stainless steel		Alu, Cu, Ms			each up to	
M3	2.600	3.000	2.500	2.700	2.800	3.600	1.350	2,0	0,75
								1,0	1,0
M4	2.300	2.600	2.200	2.400	3.000	3.800	1.000	2,5	1,0
								4,0	1,5
M5	2.200	2.500	2.100	2.300	2.900	3.700	800	3,0	1,0
								4,5	1,5
M6	2.000	2.400	2.000	2.200	2.800	3.600	650	4,0	1,5
								5,0	2,0
M8	1.600	2.200	1.600	2.000	2.600	3.200	500	4,0	1,5
								6,0	2,0
M10	1.500	2.000	1.500	1.800	2.400	3.000	400	3,0	1,5
								5,0	2,0
								6,5	2,5
M12	1.400	1.800	1.300	1.600	2.300	2.800	350	3,0	1,5
								5,0	2,0
								7,0	2,5
M14	1.400	1.600	1.200	1.400	2.200	2.500	250	3,0	2,0
								5,0	2,2
								7,0	2,5
M16	1.200	1.400	1.100	1.300	2.000	2.200	250	3,5	2,2
								6,0	2,5
								8,0	3,0
M18	1.100	1.300	1.000	1.200	1.900	2.000	230	3,5	2,5
								8,0	3,0
M20	1.000	1.200	900	1.100	1.600	1.900	200	6,0	3,0
								10,0	4,0
G1/8“	1.500	2.000	1.500	1.800	2.400	3.000	400	3,0	1,5
								5,0	2,0
								6,5	2,5
G1/4“	1.400	1.600	1.200	1.400	2.300	2.600	350	2,5	1,5
								4,0	2,0
								7,0	2,5
G3/8“	1.200	1.400	1.100	1.300	1.800	2.200	300	2,5	2,0
								5,0	2,2
								7,0	2,5
G1/2“	1.000	1.200	900	1.100	1.600	1.800	250	2,5	2,5
								4,0	3,0
G3/4“	900	1.000	800	900	1.400	1.600	200	4,0	3,0
G1“	900	1.000	800	900	1.300	1.500	150	4,0	3,5

11 How to get startet

1 THERMDRILL

2 Thread Former

3 Basic Equipment

Recommend for starters

Example of
a suitable drill press

Collet Chuck MC 2 with alu-cooling disc
- Ensures the perfect clamp of the thermal drill
- Recommended for continuous operation (much heat)

Requirements for the drill press:

Basically any good drill press can be used for thermal drilling and thread forming (tapping).

As a rule of thumb for applications up to M10:

Recommended motor capacity:	1,5 to 2,0 kW*
Speed Range :	2.000 - 3.000 RPM*
Other requirements:	Clockwise/Anti-Clockwise or Tapping Head Device Automatic Feed (recommended from 4,0 mm wall-thickness)

Your advantages:

- **Easy to use**
  Applicable with almost any drill press
- **Modular system makes it flexible and cost-effective**
  Tool requirements can be individually assorted and expanded if needed

* Varies depending on the wall-thickness and thread size. More details can be found on the THERMDRILL-Selection Table

12 Request Form

Please reply to fax: +49 60 71 / 30 23 34 or e-mail: info@thermdrill.com

Just 2 steps to get your Starterset quotation

1. Step: Let us know the thread sizes you need
2. Step: You´ll receive your individual offer

1 Please fill in the required thread sizes and contact details:

Thread sizes: Thread sizes (metric, metric-fine, pipe thread, UNC, UNF, NPT etc.)

Contact details:

Company: .....

Street: .....

ZIP-City: .....

First-/Lastname: .....

Phone number: .....

E-Mail: .....

2 Receive quotation & Check drilling machine

Based on your requirements we´ll work out an offer for tools & accessories

You will also find the necessary power data such as rotational speed and motor capacity for your drill press, milling machine or CNC center.

Order Starterset

Order the full range we´ve quoted or pick out the thread and types you need. For further assistance call our service team for help: + 49 60 71 / 30 23 29.

Fig. shows a Thermdrill Starterset incl. 1x Tool-Set FORM

THERMDRILL®

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E-Mail: info@ontool.eu

Your **distributor**

Further information at: **www.thermdrill.com**