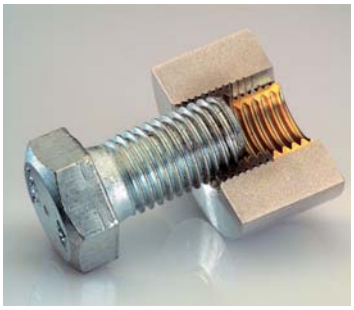
The Ensat® self-tapping threaded insert ...



Ensat is a self-tapping threaded insert with external and internal thread, cutting slots or cutting bores.
A continuous process of further development has brought about a number of major improvements to product characteristics. These inserts are protected by German and also foreign patents.

Ensat®-S 302
(with cutting slot) is recommended for most application cases. In certain materials, this Ensat demonstrates a minimal inward springing action, so creating a certain screw locking effect. If this effect is not required, we recommend using Ensat-SB 307/308.

Ensat®-SB 307/308
(with cutting bores) was developed for materials with difficult cutting properties. This insert has a thick wall and the cutting force is distributed over three cutting edges.
The short version Ensat 307 is particularly suitable where minimal material thicknesses are involved.

Thin-walled Ensat®-SD/SBD
for applications involving special space conditions (residual wall thicknesses), and also suitable for driving using a thread tapping machine (same internal and external thread pitch).
Slot version: Works Standard 303
Three-hole version: Works Standard 347/348 (see page 14).

Ensat®-SBS 337/338
with three chip reservoirs. Used primarily wherever only a small amount of chips may be permitted to occur during the tapping process (see page 13).

Ensat®-SBT 357/358
with closed floor for additional sealing from below.
(see page 15)

Fields of application

The Ensat is used throughout the whole of the metal and plastics processing industry.

Automotive industry, passenger and commercial vehicles
Engines, transmissions, wide range of supply parts such as wing mirrors, radiators, bumpers etc.

Plant and equipment construction
Flange joints, construction equipment, oil burners etc.

Household appliance and office machinery production
Vacuum cleaners, cameras, sun lamps, drills etc.

Electrical and laboratory supplies
Capacitors, heavy current, radio and telecommunication systems, dental technology equipment.

Military applications
Tanks, aircraft etc.

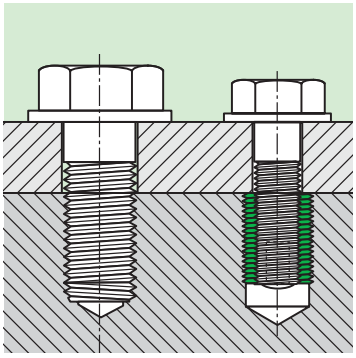
Product features

- The Ensat has a large effective shearing surface (E π B), so ensuring a higher degree of pull-out strength, i.e. an Ensat M4 is often sufficient instead of a cut M5 thread (see page 5).
- The Ensat is driven subsequently into the finished workpiece. This means a higher casting machine output, no rejects due to incorrectly cast-in insert components, no moulding sand trapped in the thread.
- A pre-cast or pre-drilled retaining hole with normal tolerance requirements is sufficient for driving in the Ensat. The thread is always precisely positioned.
- The work steps required with wire inserts – thread tapping, breaking off trunnions etc. as well as costly wearing tools (special thread drills, limit plug gauges etc.) are not needed with the Ensat-system.
- The Ensat is insensitive to small areas of shrinkage. The Ensat-system prevents damage caused by torn threads.

The Ensat®– pull-out resistance due to flange cover ...

Connections using Ensat threaded inserts permit substantially smaller overall dimensions and thus pave the way for material-saving and weight-saving designs.

The illustration below shows two screw connections with equal pull-out strength.

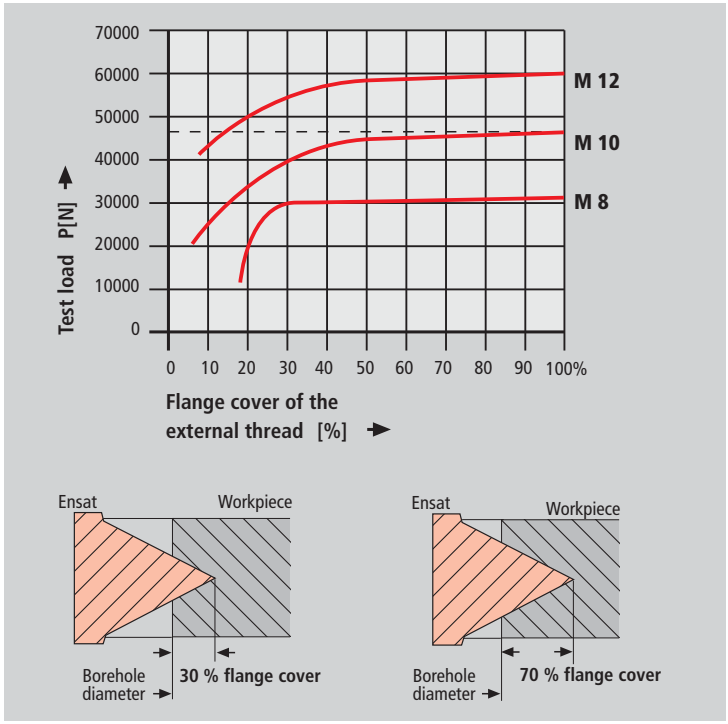


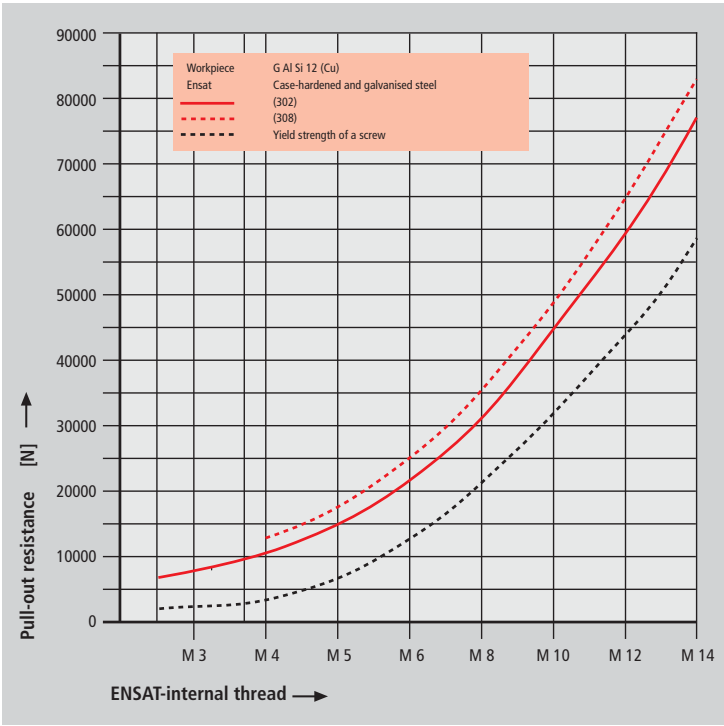
Flange cover

In a workpiece made of a light alloy, the Ensat 302 achieves almost maximum pull-out strength with only 30 % flange cover.

Pull-out strength

The Ensat is capable of withstanding high loads. When used in light alloys, for example, a degree of pull-out strength is achieved which far exceeds the yield strength of the mating screw 8.8.

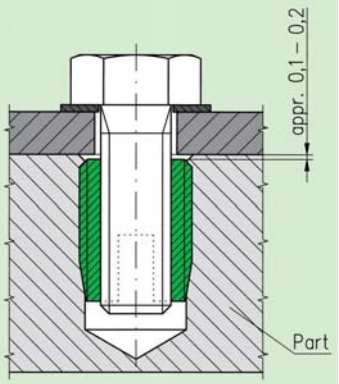




The Ensat®
in the workpiece ...

Installation recommendation

The Ensat should be processed appr. 0,1 - 0,2 mm recessed. After processing, the Ensat can be immediately subjected to load. If the component material permits subsidence of the Ensat under load, the Ensat can only execute an axial movement of 0,1 to 0,2 mm. In other words, the pretension of the screw union is largely retained, loosening of the screw connection under dynamic load is impeded.



Borehole diameter [mm]			Standard values for ENSAT 302				Standard values for ENSAT 307/308 ... 337/338			
Workpiece material	Light alloys Rm=tensile strenght [N/mm²]		R_m < 250	R_m < 300	R_m < 350	R_m >350	R_m < 300	R_m < 350		R_m >350
	Ms, bronze, NF-metall									
	Cast iron HB = brinell hardness [N/mm²]		< 150 HB		< 200 HB	>200 HB	< 150 HB	< 200 HB		>200 HB
ENSAT internal thread	M2/M2,5 M3	Zoll N° 4		4,1 4,6	4,2 4,7	4,3 4,8	- 4,6	- 4,7		- 4,8
	M3,5 M4	N° 6 N° 8	5,4 5,9	5,5 6,0	5,6 6,1	5,7 6,2	5,5 6,0	5,6 6,1		5,7 6,2
	M5 M6(a)	N° 10 -	7,2 8,2	7,3 8,3	7,5 8,5	7,6 8,6	7,4 -	7,5 -	7,6 -	7,7 -
	M6 M8	1/4 " 5/16"	8,8 10,8	9,0 11,0	9,2 11,2	9,4 11,4	9,3 11,1	9,4 11,2	9,5 11,3	9,6 11,5
	M10 M12	3/8 " 7/16"	12,8 14,8	13,0 15,0	13,2 15,2	13,4 15,4	13,1 15,0	13,2 15,1	13,3 15,2	13,5 15,4
	M14 M16	1/2 " 5/8"	16,8 18,8	17,0 19,0	17,2 19,2	17,4 19,4	17,0 19,0	17,1 19,1	17,2 19,2	17,4 19,4
	M18 M20/22	- 3/4"	20,8 24,8	21,0 25,0	21,2 25,2	21,4 25,4				
	M24 M27 M30		28,8 32,8 34,8	29,0 33,0 35,0	29,2 33,2 35,2	29,4 33,4 35,4				
Flange cover approx.			60%	50%	40%	30%	80%	70%	60%	50%

Recommended borehole diameter for easy assembly.
Other diameters may require lubrication.

These specifications are only recommendations and apply to ENSAT made of steel, hardened and plated.

The adjacent table is used to determine the recommended bore hole diameter depending on the material of the workpiece and the Ensat type/dimension.

Example:
Light alloy workpiece
(R_m=280 N/mm²),
Internal thread M8,
recommended bore hole diameter for
Ensat®-S 302: 11,2 to 11,4 mm
Ensat®-SB 307/308:11,2 to 11,5 mm

In case of processing problems (e.g. markedly increased screw-in torque levels) there is generally no harm in selecting diameter data in the next highest column. In case of doubt, we advise carrying out a test.

Retaining hole

The retaining hole can be simply drilled or integrated into in the casting.

Countersinking the borehole is recommended in order to:

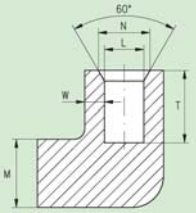
- Prevent the workpiece surface from being raised
- Permit screwing in to a greater depth
- Ensure improved initial cutting characteristics

Material thickness:
Length of the Ensat = smallest admissible material thickness M.

Depth of the blind hole:
Minimum depth -T see Works Standard sheets, page 7 to 20.

Borehole diameter:
Brittle, tough and hard materials call for a larger borehole than soft or elastic materials. For guideline values, see the table above.

Edge distance:
The smallest still admissible edge distance depends on the planned stress level and the elasticity of the material into which the Ensat is screwed.



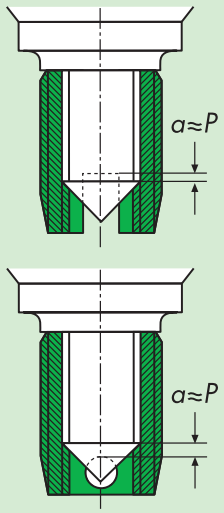
Guideline values for countersink:
N = (0,06 to 0,08 x E) +E

Guideline values for light alloys:
W ≥ 0,2 to ≥ 0,6 E

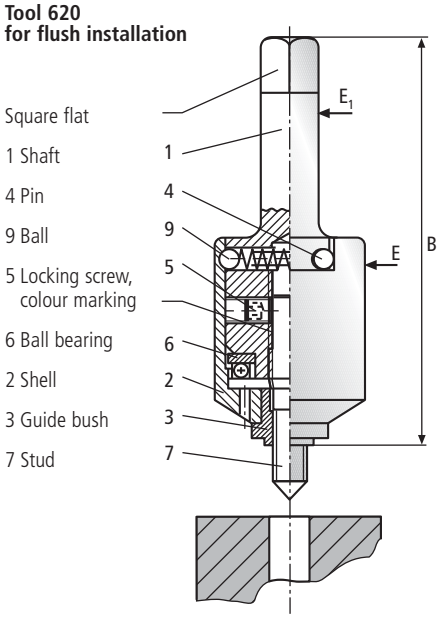
Guideline values for cast iron:
W ≥ 0,3 to ≥ 0,5 E
E = Outside diameter of the des Ensat® [mm]-

The correct length of the stud for the Ensat with cutting slot / cutting bore results from the pitch of the internal thread (see also illustration below; P=pitch of the internal thread).

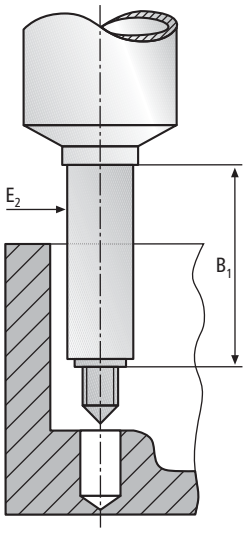
Ensat®– driving tools ...



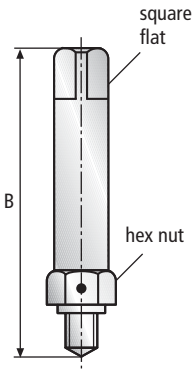
Tool 620
for flush installation



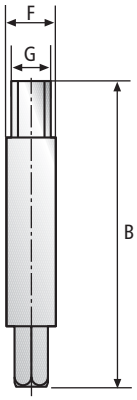
Tool 621
For deep retaining holes



Tool 610
for manual installation



Tool 6102
for Ensat-SBI



Set or exchange the stud

- Pull off the shell (2) downwards off the shaft (1).
- Release the locking screw (5).
- Screw the stud (7) in or out. The yellow colour marking indicates the flattened surfaces for the locking screws.
- When assembling, tighten both screws (5) evenly.
- Insert the ball bearing (6).
- Push on the shell (2) until the ball stop locks into place.
  To ensure that the tool functions perfectly, it must be possible to easily rotate the shell. For short Ensats, grind down the thread of tool 610 accordingly.
- If you wish the Ensat to be driven deeper than 0,2 mm below the workpiece surface, screw off the guide bush (3) at the front. Diameter. 0,1 to 0,2 mm smaller than the Ensat retaining hole.

For mounting the thin-walled Ensat (Page 14), modified guide bushes (available on request) should be used.

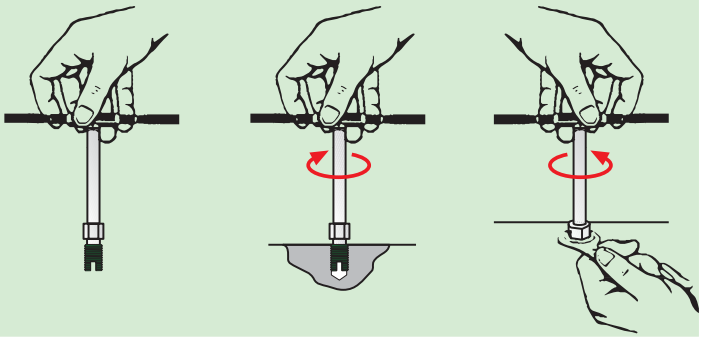
Dimensions [mm]

For Ensat®	Tool 620 Article-no.							Square SW D	Length = B	Tool 621 Article-no.			Manual assembly tool 610 Article-no.	Length = B	Square SW D	Collar SW D	For Ensat®-SBI	Tool 6102 Machine/Hand Article-no.	Length = B	Square SW G	Shank Ø F
			Whitworth	UNC	UNF	E	E1				B1	E2									
M 2	-	620 000 020	-	-	-	18	8	6,3	78	621 000 020	40	7	610 000 020	55	5	7	M 2	-	-	-	-
M 2,5	-	620 000 025	-	-	-	18	8	6,3	78	621 000 025	40	7	610 000 025	55	5	7	M 2,5	-	-	-	-
M 3	Nr. 4	620 000 030	-	620 000 604	620 000 704	18	8	6,3	78	621 000 030	40	7	610 000 030	55	5	7	M 3	-	-	-	-
M 3,5	Nr. 6	620 000 035	-	620 000 606	620 000 706	18	8	6,3	78	621 000 035	40	7	610 000 035	60	5	7	M 3,5	-	-	-	-
M 4	Nr. 8	620 000 040	-	620 000 608	620 000 708	18	8	6,3	78	621 000 040	40	7	610 000 040	60	5	7	M 4	610 200 040	80	4,9	6
M 5	Nr. 10	620 000 050	-	620 000 610	620 000 710	24	12,5	10	95	621 000 050	50	9	610 000 050	75	8	13	M 5	610 200 050	90	6,2	8
M 6	1/4"	620 000 060	620 000 525	620 000 625	620 000 725	24	12,5	10	95	621 000 060	50	10	610 000 060	75	8	13	M 6	610 200 060	100	8	10
M 8	5/16"	620 000 080	620 000 531	620 000 631	620 000 731	24	12,5	10	95	621 000 080	50	12	610 000 080	75	8	13	M 8	610 200 080	100	8	10
M 10	3/8"	620 000 100	620 000 537	620 000 637	620 000 737	32	16	12,5	118	621 000 100	60	15	610 000 100	95	12,5	19	M 10	610 200 100	110	9	12
M 12	7/16"	620 000 120	620 000 544	620 000 644	620 000 744	32	16	12,5	118	621 000 120	60	18	610 000 120	95	12,5	19	M 12	610 200 120	125	11	14
M 14	1/2"	620 000 140	620 000 550	620 000 650	620 000 750	50	25	20	145	621 000 140	60	20	610 000 140	95	12,5	19	M 14	-	-	-	-
M 16	5/8"	620 000 160	620 000 562	620 000 662	620 000 762	50	25	20	145	621 000 160	60	22	-	-	-	-	M 16	-	-	-	-
M 18	-	620 000 180	-	-	-	50	25	20	145	621 000 180	60	24	-	-	-	-	M 18	-	-	-	-
M 20	-	620 000 200	-	-	-	58	25	20	169	621 000 200	60	26	-	-	-	-	M 20	-	-	-	-
M 22	-	620 000 220	-	-	-	58	25	20	169	621 000 220	60	28	-	-	-	-	M 22	-	-	-	-
M 24	-	620 000 240	-	-	-	70	30	25	198	621 000 240	60	32	-	-	-	-	M 24	-	-	-	-
M 27	-	620 000 270	-	-	-	70	30	25	198	621 000 270	60	35	-	-	-	-	M 27	-	-	-	-
M 30	-	620 000 300	-	-	-	70	30	25	198	621 000 300	60	38	-	-	-	-	M 30	-	-	-	-

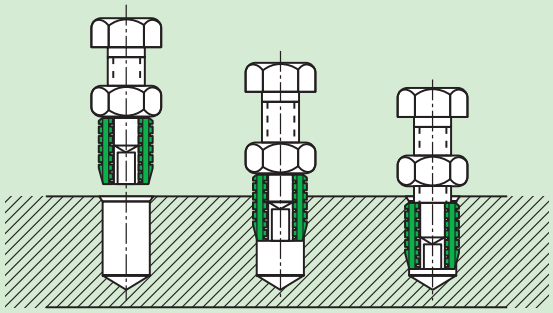
Tools 620 and 621 also fit within the coloured lines for other thread dimensions, if the guide bush and stud are exchanged.

Manual Ensat® Installation ...

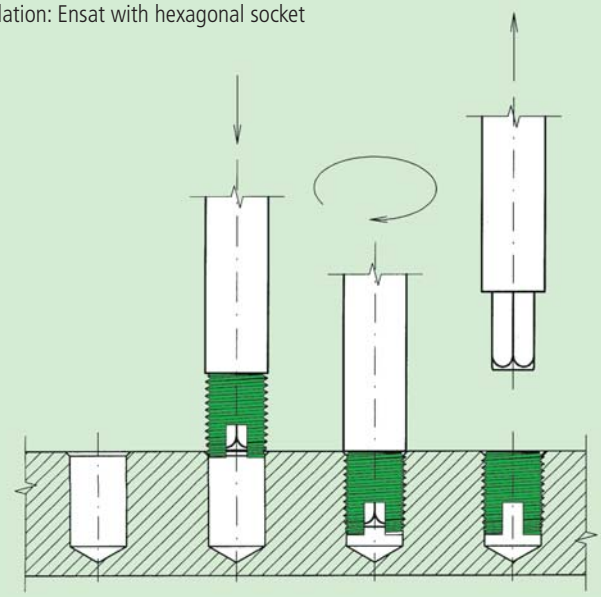
Manual installation with driving tool and tap wrench:



Emergency installation using screw and nut:



Installation: Ensat with hexagonal socket



Manual installation

Manual driving takes place using the driving tools 620, 621 or 610 and a tap wrench:

1. Drill the hole: see page 6 for the correct diameter, countersink if necessary.
2. Screw the Ensat onto the driving tool with the cutting slot or cutting bore pointing downwards.
3. Drive in the Ensat until appr. 0,1 - 0,2 mm below the surface of the workpiece. Ensure that it does not tilt! When using tool 620 and 621, the rotatable shell must rest against the externally visible stop pins in such a way that it is driven round clockwise by the pins.
4. Back out the driver tool. During this process, tool 620 or 621 is automatically released from the Ensat.
   Tool 610: Hold the hex nut using a spanner until the lock breaks.

Driving into steel

With Ensat®-S 302:
Pre-cut the thread using the drill (max. centre cutter), set the threaded stud of the tool to the full Ensat length (tool 610 cannot be adjusted).

With Ensat®-SB 307 / 308:
In steel up to medium strength, pre-cutting is not required.

Up to M12, we recommend for high-strength steel the use of **Mubux®-M**.

Mubux®-M installation

Pre-cut the retaining thread with customary thread tapping tool, then drive in as for the Ensat.

Machine installation ...

Machine driving process

1. Precisely position the workpiece to ensure that the hole and machine spindle are in exact alignment (do not tilt). Set the machine to the precise driving depth (appr. 0,1 – 0,2 mm below the surface of the workpiece).

2. Turn the machine to clockwise rotation. At the start of the driving process, the rotatable external shell of the tool must be resting against the external visible stop pins in such a way that it is driven by the pins in the clockwise direction.

3. Feed the Ensat towards the tool **(slot or cutting hole facing downwards)** and grip for the duration of 2 to 4 revolutions.

4. Actuate the operating lever of the machine until the Ensat cuts into the borehole. The remainder of the driving process takes place without actuating the feed.

5. Switch on the reversing function. Always avoid setting the tool down hard on the workpiece, as this can lead to breaking both the tool and the Ensat.

Excessively hard contact of the tool can damage the play-free fit of the Ensat and so reduce the pull-out strength. If necessary, the driving speed may have to be adapted in line with the necessary reversal time.

Machine installation takes place with production tool 620 or 621, integrated in a:

1. Thread tapping machine

2. Use a drill press fitted with a reversing tapping attachement or a tapping machine which is not pitch controlled.
Important: Never exceed the maximum admissible driving torque.

3. Special manual machine with bit stop and reversing system.

For large-scale series:

4. Single or multiple installation machines
with pneumatic or electric drive, semi or fully automatic (CNC).
Attention of different pitches.

Recommended speed values for light alloys:

Ensat® Internal thread	Speed [min^{-1}]
M 2,5 / M 3	650 - 900
M 4 / M 5	400 - 600
M 6 / M 8	280 - 400
M 10 / M 12	200 - 300
M 14 / M 16	150 - 200
M 18 / M 20	120 - 200
M 22 / M 24	100 - 160
M 27 / M 30	80 - 140

Torque M
The maximum admissible torque depends on:
1. The axial load capacity of the tool stud
2. The pressure resistance capacity of the Ensat® in the axial direction.

Guideline value for installation torque

Ensat® M 2,5	1,5 Nm
Ensat® M 3	2,5 Nm
Ensat® M 4	5,5 Nm
Ensat® M 5	10 Nm
Ensat® M 6	15 Nm
Ensat® M 8	28 Nm
Ensat® M 10	40 Nm
Ensat® M 12	60 Nm

Lubrication
Only in the case of materials with difficult cutting properties.

For medium-hard light alloys:
Cutting oil, spirit or petroleum.

For tough light alloys and cast iron:
Cutting oil with appr. 5 – 8% molybdenum sulphide.