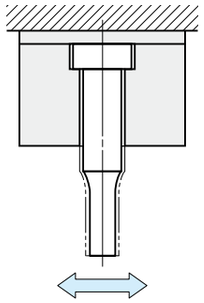
■What are heavy duty retainers for high-tensile steel?

These are products which were developed for punching of high-tensile steel or other heavy loads. During punching of high-tensile steel or other heavy loads, the retainer may become deformed, causing the punch to become loose and reducing the punch lifetime. The use of high-strength material in these heavy duty retainers for high-tensile steel prevents the retainer from becoming deformed.

■Deformation of the retainer during punching of high-tensile steel or heavy load

During punching of high-tensile steel or other heavy loads, problems occur which reduce the punch lifetime, such as rapid wear, chipping, and breakage of the punch tip. One cause of these problems is deformation of the retainer. When the retainer punch hole becomes deformed, it lacks sufficient strength to support the punch, and looseness of the tip occurs. As a result, it becomes impossible to maintain the correct clearance between the punch and die, causing uneven tip wear and chipping, and reducing the punch lifetime. (Fig. 1)
There are two major causes of retainer deformation.



Retainer punch hole deformation
↓
Insufficient punch support
↓
Loose punch tip
↓
Loss of correct clearance between punch and die
↓
Uneven wear or chipping of tip

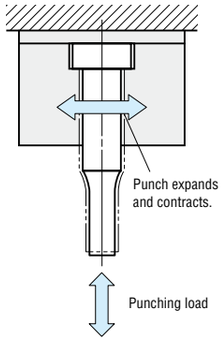
[Fig. 1] Decrease in punch lifetime due to retainer deformation

1. Deformation caused by excessive punching load

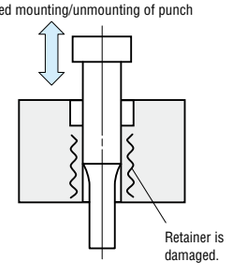
During punching of high-tensile steel or other heavy loads, the punch is subjected to large amounts of stress. This causes repeated expansion and contraction of the punch. The pressure caused by this expansion and contraction acts on the retainer, resulting in deformation. (Fig. 2)
In addition, retainer deformation may also be caused by factors such as thrust loads resulting from tilting or uneven clearance.

2. Deformation caused by repeated mounting/demounting of punch

During punching of high-tensile steel or other heavy loads, tip wear occurs faster, and frequent maintenance is necessary. Repeated mounting/demounting of the punch for maintenance may result in damage to and deformation of the retainer, which has a hardness that is lower than that of the punch. (Fig. 3)



[Fig. 2] Retainer deformation caused by excessive punching load



[Fig. 3] Retainer deformation caused by repeated mounting/ demounting of punch

■Features of heavy duty retainers for high-tensile steel

In order to resolve the problems described above, the material used for heavy duty retainers for high-tensile steel has been changed from S45C (raw material) to a material equivalent to SCM440 (hardness 36 ～ 44 HRC). Comparing the mechanical properties of S45C and SCM440 (Table 1) shows that SCM440 has a higher hardness, yield stress, and tensile strength, as well as superior wear resistance and breakage resistance, making it less likely to deform.
These properties of heavy duty retainers for high-tensile steel help to prevent retainer deformation and extend the punch lifetime.

[Table 1] Mechanical properties of S45C (raw material) and SCM440

Material	Hardness [HRC]	Yield stress [MPa]	Tensile strength [MPa]
S45C (raw material)	21 or less	345 or more	570 or more
SCM440	36 ～ 44	835 or more	980 or more

∗ Partially excerpted from former standards JIS G4051 and G4105 (1979).

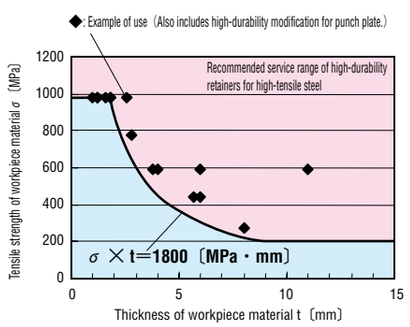
■Applications

1. Punching of high-tensile steel or other heavy loads

These heavy duty retainers for high-tensile steel deliver superior performance when the stress at the punch shank during punching exceeds approximately 500 MPa.
Consider the following service conditions as an approximate guide.
Tensile strength of workpiece material σ × Plate thickness t≧1800 [MPa・mm] (Fig. 4)
Example: If the tensile strength of the workpiece material is 590 MPa and the plate thickness is t3.2, the stress will be 590 × 3.2=1888 [MPa・mm], a figure in excess of 1800 [MPa・mm]. This indicates that the use of a heavy duty retainer for high-tensile steel is suitable.

2. Dies used for large production counts

In cases when the production count is 1 million shots or more and the die part durability is increased in order to reduce maintenance costs, the use of a heavy duty retainer for high-tensile steel is suitable.



[Fig. 4] Recommended service range and example of use for heavy duty retainers for high-tensile steel

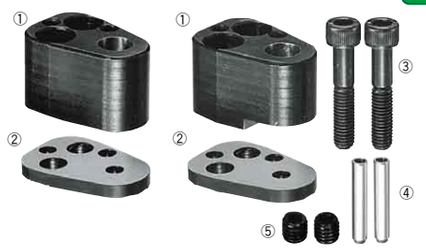
For round punch Ⓐ

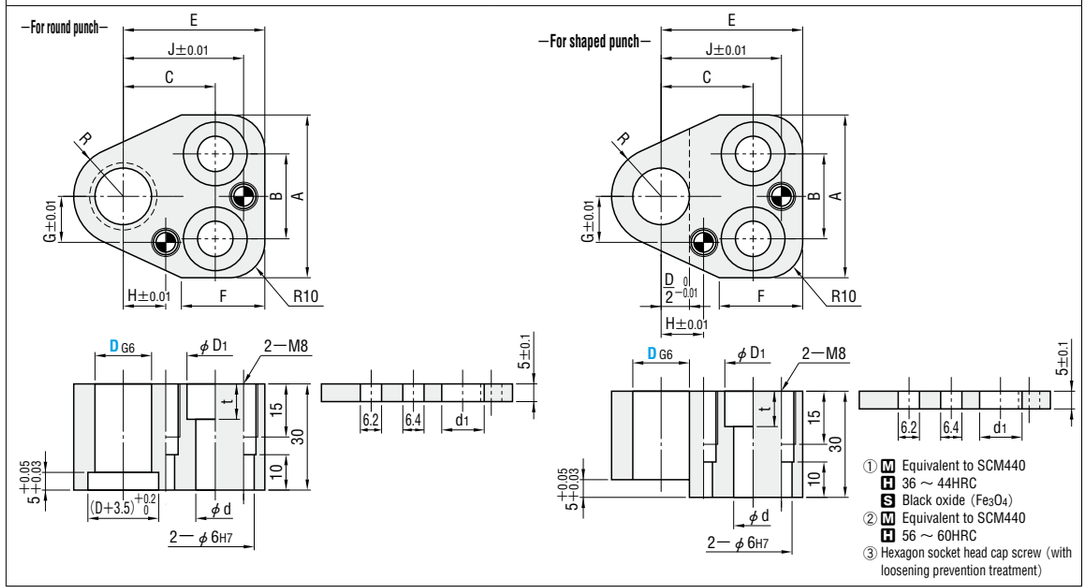
Catalog No.	Retainer No.	Components ①	②	③	④	⑤
HDP—AP	HA1	○	○	○	○	○
HDPAR	HA2	○		○	○	○
BPC	—		○			
HDP—AN	HA3	○				

For shaped punch Ⓓ Ⓡ Ⓔ Ⓖ

Catalog No.	Retainer No.	Components ①	②	③	④	⑤
HDP—FP	HF1	○	○	○	○	○
HDPFR	HF2	○		○	○	○
BPC	—		○			
HDP—FN	HF3	○				

—For round punch— —For shaped punch— RoHS





Catalog No. Type —For round punch—	Catalog No. Type —For shaped punch—	D	D_{G6}	A	B	C	E	F	G	H	J	R	D_1	d	t	d_1	Ⓐ ③④⑤
HDP—AP (①②③④⑤)	HDP—FP (①②③④⑤)	10	+0.014 +0.005	37	20	21	35	20	10	9	29	9.5	14	9	10	10	③M8—40 ④MSTM6—30 ⑤MSW8
HDPAR (①③④⑤)	HDPFR (①③④⑤)	13	+0.017 +0.006	43	26	23	38		13	11	32	12					
		16		44	24	26	40			12	34	14					
BPC (②)	BPC (②)	20	+0.020 +0.007	48	28	27	42		16	14	36	17	17	11	12	12	③M10—40 ④MSTM6—30 ⑤MSW8
HDP—AN (①)	HDP—FN (①)	25		50	30	30	46		18	17	39	19.5					

Order — Catalog No. HDP—AP 25

Price — Quotation

Days to Ship — Quotation

RETAINERS