TRIMMING DIE'S ADJUSTMENT

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ABSTRACT: If the Trimming Die, is used very much, before or afterwards, inside the time, will go wrong.
The Trimming Die's manufacturers it is told the duration of the lifetime of the Trimming Die (20.000-50.000 and more).
This number may be more, but there may be much less. This number depens on how we are care of the Trimming Die, during mounting and fixing on the hydraulic press or during the trimming operation. My objectives is to reduce the maintenance time of the Trimming Die, and with this to increase the production number.
KEYWORDS: trim die's, adjustment, redesign

1. INTRODUCTION (HEADING 1)

Today's, the trimming die's manufacturers are focused to involve at to reduce the scrap rate of the trimming operation and to reduce of costs. By used the CAD/CAE/CAM softwares, we can able to reduce the designing process time and the tryout time, and with us will be able to reduce the costs and to eliminate the scrap rate and the redesign time. But so, it is necessary the validating of the trimming die's . Using CAE methods will be able to eliminate the fine tunning totally or partialy (virtual tryout), after then the trimming die is ready. With modern designing softwares we can simulated the potential design defects and corrected in the design phase. But if after all necessary to modify the trim die after tryout, we are two mods it's possible:

- redesign of the trim die
- fine tuning

Always is needed slowly and carefully work when we do the fine tunning. It is very important to establish the technological process. Steps to check the trimming die's (new/old):

1-checking defects on the trimmed part

2-die block (support)

3-cutter

4-pins

5-auxiliary parts of the trim die

The Trimming Die's may go wrong from many reasons, for example:

- -the hydraulic press does not work very well
- -the program of the hydraulic press is not conform
- -the castshot (parts) is not placed correctly on the support of the Trimming Die
- -the operator (worker) does not work adequately, conform work instruction, etc.
- -cutters and pins of the trimming die's are worn out
- -the trim die is not fixed on the center of the hydraulic press

If we are care on of the Trimming Die and we work carefully with him , we aren't any problems very-very long time .

But, if we have some problems with the Trimming Die, we find the root cause of the problems very quikly because he shows on the parts if there is some problems with the Trimming Die (friction, missing of material etc), figure 1,2.

If we goes wrong after all the Trimming Die, as the first step, let us not take it to pieces the Trimming Die till then we do not know the accurate, place of the problems and his reasons

Figure 1. Missing material.

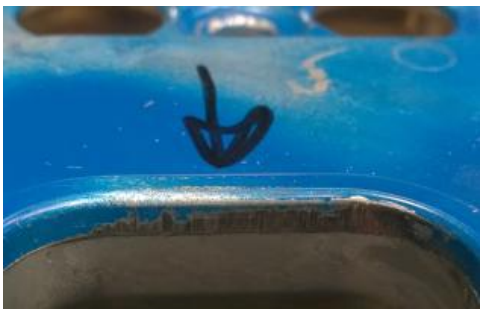

Figure 2. Friction.

When we found any problems on the trimmed parts, we may find exact the reasons of the problems on the trimming die. It is possible that the cutter's or pins is worn out, figure 3.

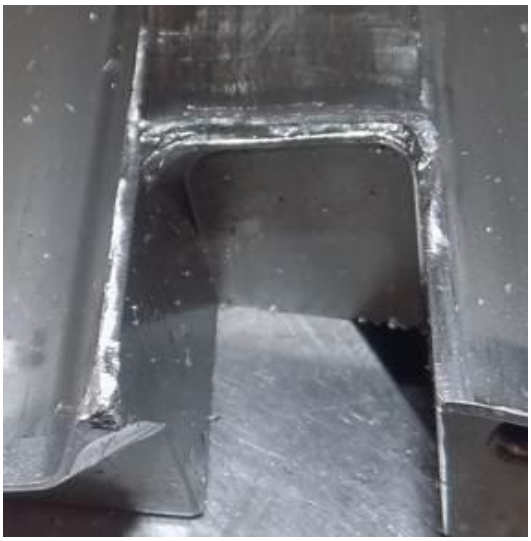

Figure 3. The top of the cutter is worn out.

In this situation we need to weld it with laser or with TIG (to recharge material).

It is very very important that we know it the chemical composition of the basic material (cutter, pins, etc…) and of the addition material (electrode) [1]. The chemical composition of the addition material must be at same with the chemical composition of the basic material, especially the carbon content, eventually, the carbon content in the additional material may be lower then in the basic material (because of this, the additive material, infiltrates better on the basic material). Usually, we used material for the:

- cutter-1.2379 (X155CrMoV12)
- pin-1.2842 (90MnCrV8)
- additional material (electrode)

The chemical composition of the cutter is, [6]:

1.2379 / X153CrMoV12

DIN 1.2379 / X153CrMoV12 Steel is a high carbon and high chromium type cold work tool steel. The Molybdenum and Vanadium compositon of din 1.2379 is more than 1.2601 steel. X153CrMoV12 steel has higher strength and toughness,which makes the comprehensive performance of 1.2379 steel better.

Chemical Composition

C: 1.45-1.60; Si: 0.10-0.60; Mn: 0.20-0.60; P: max0.030; S: max0.030;

Cr: 11.00-13.00; Mo: 0.70-1.00; V: 0.70-1.00;

Equivalent Grades

Germany: X155CrVMo12-1

AISI/ASTM: D2

JIS: SKD11

Form of 1.2379

Round / Square / Flat Bars, Plates, Blocks

Hardness of X153CrMoV12 Steel

Annealed (+A): max 255HB

Applications of DIN X153CrMoV12 Steel

DIN 1.2379 steel is used to make high wear resistance of large and complex cold work tool steel,such as cold cut shear blade,cutting die,piping mode,gauge,drawing die,thread rolling die,thread rolling dies,punch,etc.

Enquiry for DIN 1.2379 / X153CrMoV12 Tool Steel Round / Flat Bar, Plates, Blocks.

The chemical composition of the pins is,[5]:

90MnCrV8 | 1.2842 is a German Cold work tool alloy steel material grade.it is shock resisting steel. it belong to DIN 17350 standard. Digital Grade material number 1.2842. Metal Steel Grade W-Nr 90MnCrV8. It is a die steel, use in extrusion moulds, Hot Cast moulds. like aluminium production, Aluminium cutting mold. Our Tool Steel material 100 % ultrasonic tested with good price. Small size steel products make by hot rolled, large size steel products make by forging. 1.2842 with 902MnCrV8 is equivalent Belong to W-Nr and DIN.

Chemical composition data:

C:0.85 – 0.95; Si:0.10 – 0.40; Mn:1.90 – 2.10; P:0.030 max; Cr:020 – 0.50: V:0.05 – 0.15.

Physical properties of 90MnCrV8 | 1.2842 Tool Steel

- Density: 7.85kg/m3
- Thermal conductivity:
- Forging ratio: 5:1 Minimum
- Microstructure:
- Magnetic:

Mechanical properties of Alloy Steel 90MnCrV8 | 1.2842

Hardness： Annealing 225 HB max, Q+T: 50~63 HRc, different hardness according different Tempering temperature.

- Yield strength:

Heat treatment of 90MnCrV8 | 1.2842 Cold work tool steel

- Annealing: Annealing temperature/℃: 680~720; After the annealing, degree of hardness ≤HBS: 225
- Quenching: Hardening temperature/℃: 790~820, Quenching in oil
- Tempering: Commonly used drawing temperature/℃: 180~250; After tempering hardness HRC | 100 ℃ : 63; After tempering hardness HRC | 200 ℃ : 60; After tempering hardness HRC | 300 ℃ : 56 ; After tempering hardness HRC | 400 ℃ : 50
- Normalizing ： at Normalizing temperature, then cool in furnace

Chemical properties of the additional material (electrode),[4]:

Chemical composition % of steel C45 (1.0503): EN 10277-2-2008

Cr + Mo + Ni = max 0.63							
C	**Si**	**Mn**	**Ni**	**P**	**S**	**Cr**	**Mo**
0.43 - 0.5	max 0.4	0.5 - 0.8	max 0.4	max 0.045	max 0.045	max 0.4	max 0.1

Mechanical properties of steel C45 (1.0503)

Nominal thickness (mm):	to 16	16 - 100	100 - 250	250 - 500	500 - 1000
Rm - Tensile strength (MPa) (+N)	620	580	560	540	530

Nominal thickness (mm):	5 - 10	10 - 16	16 - 40	40 - 63	63 - 100
Rm - Tensile strength (MPa) (+C)	750-1050	710-1030	650-1000	630-900	580-850

Nominal thickness(mm):	to 100	100 - 250	250 - 500	500 - 1000
Re - Upper yield strength (MPa) (+N)	305	275	240	230

Nominal thickness(mm):	5 - 10	10 - 16	16 - 40	40 - 63	63 - 100
$R_{p0.2}$ 0.2% proof strength (MPa) (+C)	565	500	410	360	310

Nominal thickness (mm):	5 - 10	10 - 16	16 - 40	40 - 63	63 - 100
A - Min. elongation at fracture (%) (+C)	5	6	7	8	8

Nominal thickness (mm):	to 16	16 - 100	100 - 250
A - Min. elongation Lo = 5,65 √ So (%) (+N)	14	16	16

Brinell hardness (HBW): (+S)	255
Brinell hardness (HBW): (+A)	207
Brinell hardness (HBW): (+SH)	172 - 242

Properties of steel C45 (1.0503)

Weldability: Due to the medium-high carbon content it can be welded with some precautions.
Hardenability: It has a low hardenability in water or oil; fit for surface hardening that gives this steel grade a high hardness of the hardened shell.

2. FAILURE OF THE TRIMMING DIE'S

The trimming die's before or afterwards will be defected, this defect or failure may be due to:

- -the cast shot was not placed correctly on the support
- -the trimming die is not cleaned
- -wrong program of the press machine
- -careless operator

Problems that appear with the trimming tool

Figure 4. Support breakage.

Figure 5. Support worn out.

Figure 6. Missing material (cutter).

Figure 7. Support breakage.

Figure 8. Worn out (lower cutter).

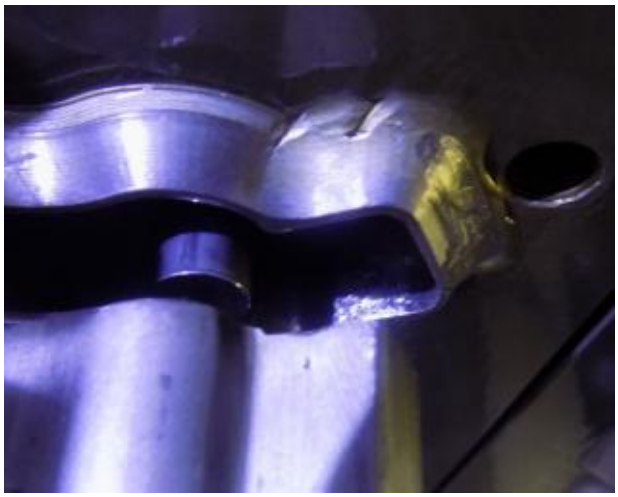

Figure 9. Worn out (upper cutter).

Figure 10. Worn out (cutter).

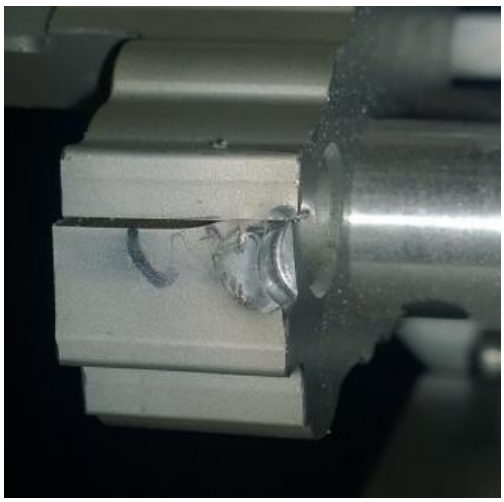

Figure 11. Breakage (punch plate)

3. CASE STUDY

Depending on the thickness of the ingate what will be cut of, the angle of the cutters will be changes automatically (the main and secondary attack angle of the cutter).

The support under the cast shot and under the ingate must be flatt and in contact with him. If he does not contact it with the ingate, figure 4,5,7, when the cutter come down and cut down the ingate, the ingate there is nothing under it that let him keep it, the cutter will not cut down it but it will break down and we have missing of material on the ingate zone.

Due to the several causes, may occur problems with the die blocks (cutter, pins, support), for example:

- -temperature of the cast shot
- -thickness of the ingate
- -primary and secondary angle of the cutter and pin, figure 6,8,9,10

If the castshot is very hot when will be cutted, on the internal side of the cutter, remain soldered material, which leaves friction on the surface of the trimmed parts.

If the trimming die is designed for the parts which has a temperature 50° (for example) , when we cut down the ingate and the burrs from the parts who has a temperature 100°-150°,we will get into the geometry of the parts, or we can not even sit down the castshot on the support, figure 12.

For example to aluminium, at 100° we have a difference 1,5mm.

Figure 12. Distance between the support and part, caused by temperature.

If anything happens with the trimming die, in the first step are necessary to checked the root cause of the problems. At the first, we try to adjust the trimming die without redesign. If he is needed, let us recharge it then or we are milling/ rectifying, figure 13,14.

Figure 13. Milling (cutter).

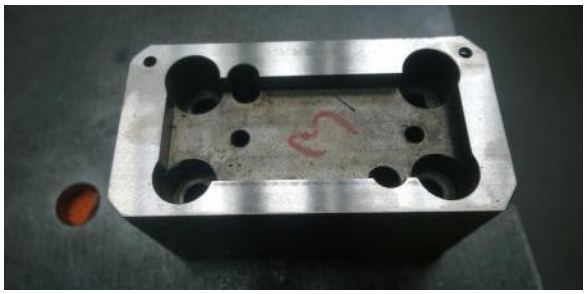

Figure 14. Rectification (support).

Figure 15. Welding with TIG

Figure 16. Heat treatment (cutter)

When we finished the modification on the trimming die, it is necessary to use heat treatment on the active zones (completely os partialy).

After the adjusting it is necessary to us local heat treatment for to have more resistivity, figure 16.

But if we can not adjust the trimming die, then we have to redesign.

If is not possible to solve the problems by welding, figure 15, [2] milling or with any tehnological process to save components of the Trimming Die, it is necessary to modify the Trimming components (cutters, support, pins), figure 11.

Or we order a new component, or we make a redesign on the Trimming Die that let him work better and adequately.

Figure 17. Overflow breakage .

For this problem (missing material) it is necessary to redesign the Trimming Die, figure 17. The Trimming Die manufacturers, in the design phase, used the CAD/CAE /CAM softwares [7][8] can be eliminate the eventually problems, but only in the tool try out phase can be noticed the realy problems with the trimming die, because it's not sure that in the 3D model how to behave the cast shot.

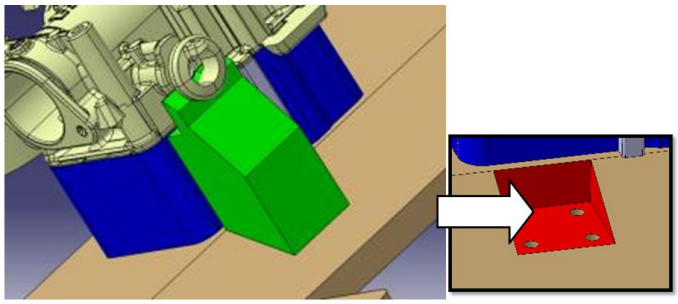

Figure 18. Add lower cutter

If we can to redesign the Trimming Die components (cutter,support). We have a proposal, a new design whit this backside cutter:

- -We add a new cutter on the bottom/fix side - green marked part, figure 18.
- -Creating a pocket
- -We machine the top cutter creating a pocket to avoid collision with the new added cutter.
- -The idea is to let both of the cutters work at the same time - simultaneously
- -The cutters shape has to be roud shape, othervise it touch the ingate of the overflow only on the top, figure 20.

Proposal for the new cutter shape

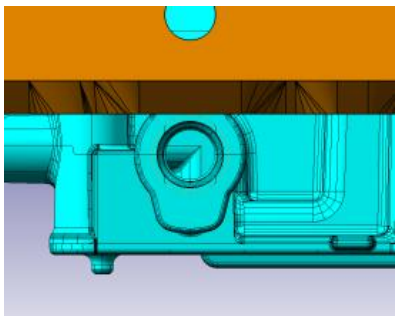

Figure 19. Old upper cutter before modification (old concept).

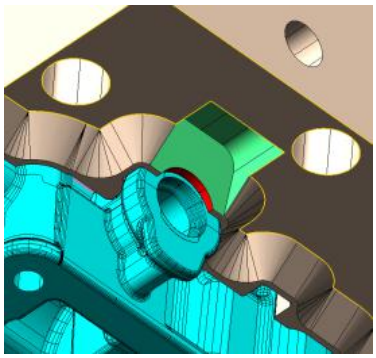

Figure 20. Redesign upper cutter (new concept).

4. CONCLUSIONS

In the first step, we need to analyze very very well and think about more solution, then we start the modifications.

Let us keep an eye on it that before we would start to modify it the Trimming Die because not only the

Trimming Die may be the reasons of the problem, for example:

- -the hydraulic press does not work well
- -the program of the hydraulic press is not conform
- -the castshot (parts) is not placed correctly on the support of the Trimming Die
- -the operator (worker) does not work adequately, conform work instruction, etc.\

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