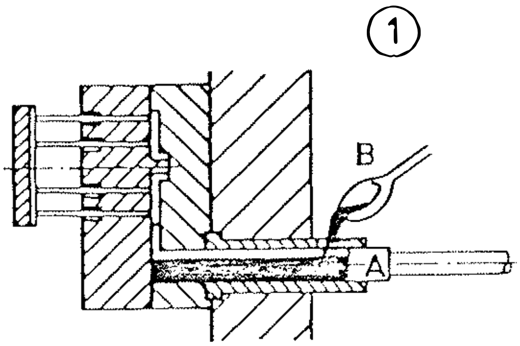
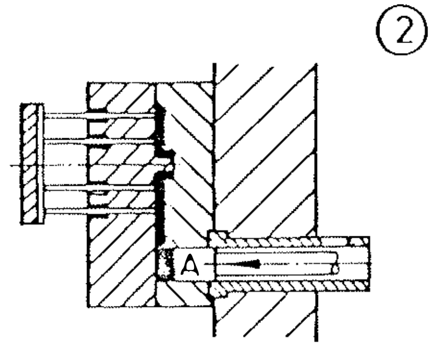
6. Casting operation

6.1 Operating principle

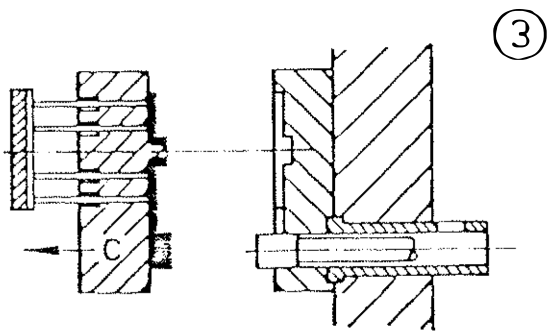
6.1.1 Horizontal injection sleeve



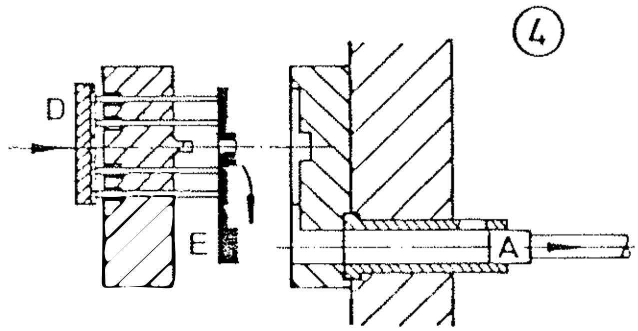
With the injection plunger retracted, the molten metal is poured into the sleeve through the open filler opening (B).



Injection plunger A injects the molten metal into the die (injection in three phases - refer also to 3.3.3)



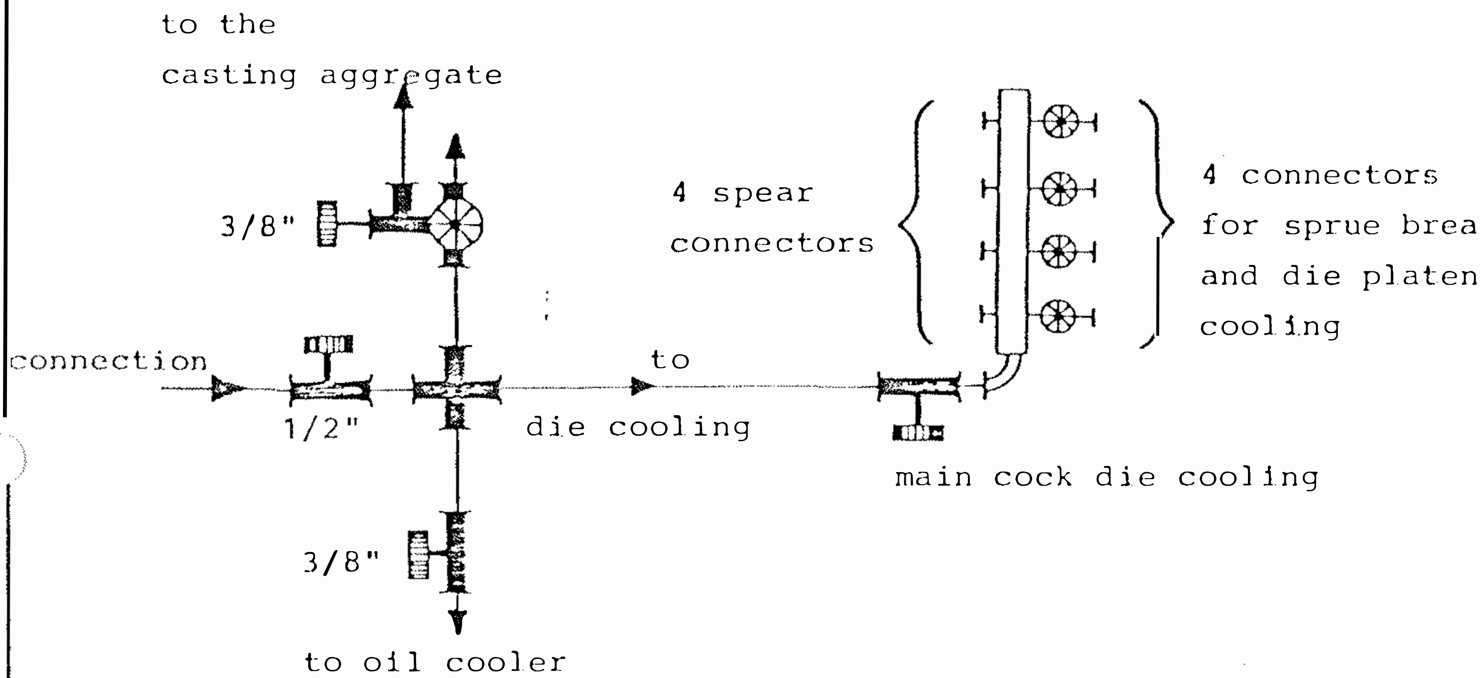
Die half C (together with the die-cast part) retracts to the left, the die opens.



Ejector D ejects the die-cast parts from the die using the ejector pins; the part is removed; gate E is parted off.

6.2 Cooling Facility

The cooling is made with water, a pressure of 5 atmospheres is sufficient.



For water cooling connections we recommend "oilresistant hose". In case of frost, drain water to avoid bursting.

Maintenance: Keep return control tank clean. Clean and well filtered water is the precondition for trouble-free operat-ion. Contaminations in the pipes and oil cooler reduce the performance of the machine.

During short breaks it is sufficient to simply turn-off the main cock die cooling. Prior to every commissioning the cocks to the casting aggregate and to the oil cooler must be opened.

6.3 Setting-up for casting operation

We recommend that only those pressure die-casting alloys given in the DIN sheet should be used. Remelted alloys should be used only for subsidiary purposes.

Recommended metal bath temperatures:

Lead alloys	300 - 320°C	Magnesium alloys	630 - 660°C
Tin alloys	200 - 220°C	Aluminium alloys	650 - 680°C
Zinc alloys	400 - 420°C	Copper alloys	900 - 950°C

6.3.1 Setting the die

1. Mount the fixed die half on to the fixed die platen.
2. Suspend the movable die half from the guide bars (suspend from crane or similar or otherwise secure due to danger of accidents).
3. Should tie bars have been extracted, then these are to be re-inserted and fixed.
4. Set locking parts to the necessary die height.
5. Screw ejector dowel into the die.
6. Slowly close the locking parts (throttle). As they close the ejector dowel advances into the lock of the ejector, from which the lock bar has previously been removed.
7. Clamp movable die half to platen.
   Mount lock bar for ejector dowel and secure.
8. Set ejector stroke such that the ejector plate in the advanced position has a clearance of about 5 mm in the die, in order to prevent the full ejector force acting on the die.
9. Switch off machine and wait until pressure gauges no longer indicate pressure.
10. Connect up core puller piping (see Section 3).
11. Connect core puller and ejector plugs.

Caution: Checking the correct functioning of the machine with ejector and core pullers may only be carried out after the die has been warmed up. Care must be taken, that, for vertical machines, between nozzle and nozzle system and, for horizontal machines, between injection sleeve and die, there is a clearance of 0.1 mm.

6.3.2 Preheating the pressure die-casting die

After mounting the pressure die-casting die it is now necessary to preheat this to the necessary temperature. Employed are, primarily, rod or circular shaped burners, to be made by the manufacturer, and which are positioned either below the die or between the die halves. During positioning, care must be taken that parts which can easily be overheated such as ejector pins and thin-walled core parts are retracted to prevent these from losing their hardness. The use of a welding burner for this purpose is, under all circumstances, unacceptable, because of the danger of excessive local heating.

Recommended die temperature:

Lead alloys	140 - 160°C	Magnesium alloys	250 - 280°C
Tin alloys	90 - 100°C	AL alloys	200 - 250°C
Zinc alloys	180 - 200°C	CU alloys	280 - 320°C

For temperature monitoring, the coloured indicator rods supplied by the A.W. Faber-Castell company, Nuremberg, have proved themselves most satisfactorily in practice.

6.3.3 Setting the necessary closing force

The double knuckle-jointed system employed requires the correct setting of the locking parts. The casting forces occurring during injection can only be taken up without difficulty, if the entire locking mechanism has a certain pre-load, which is greater than the casting forces acting on the die. It is important that this setting operation is only carried out after the pressure die-casting die has been preheated, since otherwise the longitudinal expansion of the die as a result of heating up is not taken into account. Setting to the required closing force is carried out as follows:

Motor-driven central die-height adjustment:

By means of the pushbutton "die height" on the control console, the die height is set. Upon operating the switch "up" the die height increases. Setting must take place for that value for which the die still remains exactly closed, that is, the knuckle-jointed system must be pressed together in the end position. Pre-tensioning can be to the maximum value, since the locking cylinder is so dimensioned, that should the permissible closing force be exceeded, the machine can no longer be closed. After the final setting, the driving shaft of the gear-reduction motor is automatically blocked.

6.3.5 Setting the injection speed

Endeavours are to be made to select the injection speed to be as low as possible. This facilitates escape of air enclosed in the die, vibrations of the machine due to the impact are limited to the absolutely necessary value and thus the service life of the machine is increased. Only when manufacturing thin-walled parts or parts that have to be electro-plated, should use be made of the maximum injection speed facility. To begin with, relatively low injection piston speeds and injection pressures are used and these are then increased to the absolutely necessary value during the course of casting.

- See 3.3.3 - Hydraulic control of injection cylinder with multiplicator -

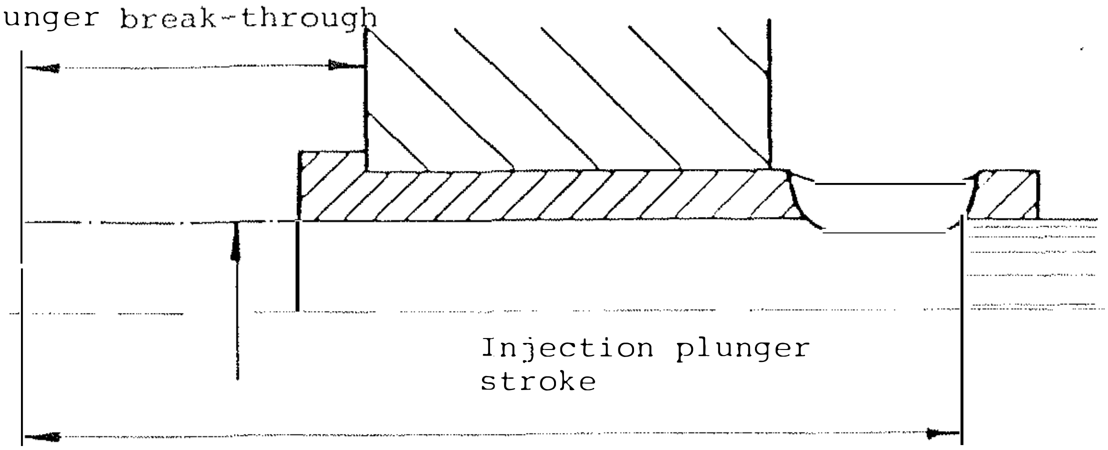
6.3.6 Commencement of casting

Before triggering the shot the throttle for regulating injection speed must, first of all, be opened only half-way, the timing clock for plunger, dwell and solidification time is to be set to approx. 3 sec., the die must be thoroughly cleaned, plunger, cores and ejector pins are to be lubricated and the temperature of the die is to be checked. To start with, the die cooling system remains shut off. The first castings made will, in most cases, show surface waviness and weld marks, since the correct die temperature has not yet been attained. It is possible only to check the correct setting of the timing clock for plunger dwell and solidification time. Thick-walled parts require a longer solidification time than thin-walled. The solidification time should be set such that the die-cast part already holds its shape but can still be ejected without difficulty. If cooling is excessive there is a danger that the die-cast part can no longer be lifted clear of the die-half due to shrinkage. Only after a series of injection shots will usable parts result. Before modification to the tools (gate and venting) are made, a sufficient number of trials with various injection plunger speeds and bath temperatures must be carried out. Once again, however, reference must be made to the danger of overheating the metal. The die may not be cooled down until unmistakable indications of overheating (blow-holes in the die-cast part) become evident. Attention must also be drawn to the fact that parts with high surface finish requirements require the shortest charging time of the die, that is, high injection plunger speeds as well as high die and metal bath temperatures

6.3.8 DETERMINATION OF THE MAXIMUM WEIGHT OF CASTINGS

For cold chamber pressure die-casting machine with horizontal injection sleeve arrangement.

Weight of casting = Weight of part + gate



The maximum weight of casting is determined from the injection sleeve charging volume taking into account that the sleeve is only 2/3rds filled.

Weight of casting G .... kg

$$G = 0.66 \times \frac{D^2 \times \pi \times h}{4 \times 1000} \times \gamma \quad \text{......kg}$$

D = Injection sleeve dia. .... cm

h = Injection plunger stroke .... cm

γ = Specific weight of the alloy

γ = 1.8 kg / dm^3 for Mg-alloy

γ = 2.7 kg / dm^3 for Al-alloy

γ = 6.7 kg / dm^3 for Zn-alloy

γ = 8.5 kg / dm^3 for Cu-alloy

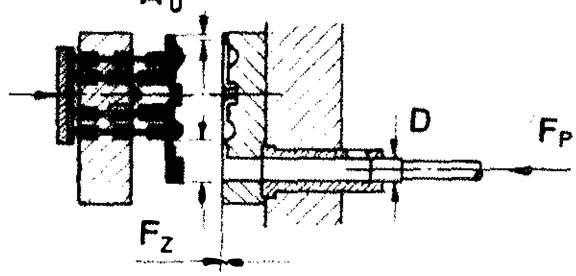
Calculating the casting area

Factors:

F_P = Injection pressure force (N)
F_Z = Locking force (N)
D = Plunger Diameter (cm)

Looked for:

p_E = Specific pressure on metal (N /cm2)
A_S = Casting area (usable) cm 2
A_K = area of casting piston



Casting area = area of part (nett) + metal feed area + sprue & overflows

$$A_S = A_T + A_L + A_Ü$$

Specific pressure on $\dfrac{\text{injection force}}{\text{area of castin piston}}$

Usable casting area = $\dfrac{\text{locking force}}{\text{injection(force) pressure}}$

$$A_S = \frac{F_Z}{p_E} \qquad \frac{(N}{(N/cm^2} = cm^2$$

$$A_S = \frac{F_Z}{\frac{p_E \times 4}{d2 \times 3,14}}$$

$$A_S = \frac{F_Z \times d2 \times 3,14}{p_E \times 4} \qquad \frac{(N \quad \times cm2}{(N} = cm^2$$

Usable casting area = $\dfrac{\text{locking force} \times \text{area of casting piston}}{\text{injection force}}$

6.5 Instructions for Extracting Tie Bars DAK 63/ 100 h

To facilitate changing dies the upper tie-bars can be extracted. The extraction of the tie-bars is carried out in the following sequence:

1. Unscrew furnace side nut and counter nut.

2. Loose guard plates of central adjustment.

3. Mark exactly tooth and tooth space of gear rim of bars to be extracted.

4. Loose counter support from crosshead.

5. Extract tie-bars.

Assembling in reverse order.

Attention: At extracted tie-bars it is not allowed to set the central die height adjustment.