# Selecting the best release agent

*Choosing the best release agent is a vital contributor to trouble-free production.. Photo courtesy Fondermetal SPA, Sotto Il Monte, Italy.*

**Jodovit's Antonio Pagliarini explains the choice of a water-based release agent and its application through air-fluid lubricators on horizontal cold chamber machines.**

When pressure diecasting non-ferrous alloys, the choice of the release agent is very important. With specific reference to aluminium alloy pressure diecasting using horizontal cold-chamber machines, the three main criteria required by the release agent are:

- Formation of a separator layer (amorphous oxide) on the surface of the steel die with the double function of avoiding welding of the alloy and to facilitate part removal.
- Static and dynamic lubricant function. Static in contributing to the formation of a separator layer between the die and the metal, dynamic to allow the detachment (extraction using sliding friction) of the diecast part, namely allowing it to 'slide' on the shape which produced it, without producing any deformation. The lubrication function is also extended to all movable parts of the die.
- Cooling, carried out by the joint action of the water used to transport the active principles inside the release agent and by chemical products present inside the formulation which bring to the formation an amorphous oxide layer at low thermal conductivity during the die spraying phase.

**Two types of release agents**

Release agents may be divided into two groups - synthetic and semi-synthetic. The synthetic ones generally contain siloxans, waxes and esters as their main active ingredients. The semi-synthetic ones additionally contain mineral oil of mainly a paraffin character.

Before use, the release agents are diluted in water in percentage from one to three. Initially, the products have an active principle content varying from 15% to 40%, the remainder of the formulation being water. This indicates just how low is the quantity of active principle deposited on the die during the release agent application phase.

The contents expressed in % weight or volume of the active principle inside the release agent and its chemical nature should be indicated on the supplier's technical data sheet in order that it may be used correctly. If, for die cooling a high volume of release agent has to be used, it is preferable that it has a low content of active ingredients. This should be sufficient to grant part removal but avoid the formation of lacquers and sludge on the surface of the die or castings and gas inside the diecast part.

By analysing what happens during the application of the release agent on the hot die during operation we find:

- Evaporation of the water in contact with the hot surface of the die (Leidenfrost effect: the water droplets in contact with the hot surface bounce and do not wet the die but remove heat by lowering its temperature to its wettability temperature). Meanwhile, other important things happen, as for example the formation of an amorphous oxide on the surface of the die, which covers its micro-roughness. The amorphous oxide layer has, in its turn, internal porosity, which is anchored by the film composed by the active principle of the release agent.
- The die wettability aspect is important and must be investigated. The parameters to be analysed are the temperature, the release agent spray pressure, the incidence angle of the spray to the die, the distance of the lubricator nozzle heads to the die, the shape of their spray rose and the quantity of applied emulsion.

**Die temperature reduced**

If only water is used and the release agent diluted say at 2%, by operating with the same nozzles, the same pressure and by applying the same quantity, it will be found that the temperature of the surface of the die after the application of the release agent is considerably lower than those obtained with pure water. This is because the amorphous oxide layer formed in the presence of the release agent on the hot die has a low thermal conductivity. It works as an insulator between the steel die surface and the active principles contained inside the release agent, thus facilitating their adhesion to the porous surface of the amorphous oxide layer.

This reaction delays the formation of cracks on the dies, thus contributing to lengthen their life.

The spray pressure is fundamental as if the pressure is high an aerosol is formed with coarse atomisation - ideal for the Leidenfrost effect on very hot dies. If the pressure is low, an aerosol at thin atomisation results suitable for dies operated at lower temperature. Normally the air pressure is always higher - at least one bar - in comparison to that of the release agent. Usually pressures of five to six bars for the air and four to five bar for the release agent are found.

During spraying, the incidence angle is included between 40 and 60°C positioned

from bottom to the top in comparison to the die. The distance of the nozzles from the mould surface is a parameter that should be evaluated. If they are too near they can provoke thermal shock and premature appearance of cracks and if too far away they provoke spray inefficacy.

The nozzles typology has to be defined case by case, where the spray rose is inefficient extensions composed of small copper tubes are used that allow difficult areas such as undercuts or areas with particular need of cooling or lubrication to be reached.

Spray nozzles have undergone different evolutions by passing from the traditional ones to silent ones (working environment noise reduction) with different possibilities of orientation. It is suggested that the supplier be contacted to help determine the most suitable typology in accordance to technical performances.

A final consideration on release agent application is that not all parts of the die require the same quantity of release agent. The cooler parts or the movable parts require different quantities from the hot areas as for example the pins, which notoriously heat up. For this reason, the application of release agent has to be programmed case by case.

**Which release agent to use**

Depending on the type of alloy, the part being diecast, the temperature of the dies, whether or not there is temperature control etc etc, the user should contact the supplier who will then recommend his most suitable product. However, the following general rules may be considered:

- Dies with very hot surfaces having points higher than 320°C. Use release agents of a synthetic nature due to their good thermal stability and low tendency to form lacquers and sludge. Nozzles should be near the die and aerosol at medium-coarse atomisation. Use high-pressure air of five to six bar and release agent pressure three to four bars.
- Dies with temperature points included between 290 and 320°C. Semi-synthetic release agents can be used containing a siloxanic component or an ester. Nozzles should have an average distance of 20-30cm, with aerosol at medium-thin atomisation. Air pressure should be four bar, release agent three bar.
- Dies with temperature higher than 150-170°C but lower than 290°C. Release agents with a low content of active principle and in high dilution can be used, preferable those with mineral base and with low wax content. Aerosol with very thin nebulisation. Nozzles distance to be determined in practice in accordance to the characteristics of the die, low pressures, for example air three to four bar, release agent two bar maximum.

Jodovit Srl; tel: (+39) 0331 301086; fax: (+39) 0331 301615; antonio.pagliarini@jodovit.com; www.vd-group.it. Sister company; F. Lli Vedani SNC.