Selection criteria for the solar module

When designing a solar system, it is important to ensure the proper circulation of the vector fluid in the solar circuit, so the choice of the module is closely related to the assessment of the load losses.

The required project data is the expected flow rate on the solar circuit (Qs); it depends on the efficiency of the solar collectors, inclination, irradiation, wind speed, fraction of the thermal load assigned to the solar, temperature, etc. (in standard working conditions it's acceptable to consider 0.7-0.8 Lt / min per 1 Sq.m of solar panel).

When entering the solar circuit flow (Qs) in the diagram below, two values are found on the axis of the pressures:

Pp: Pump prevalence;

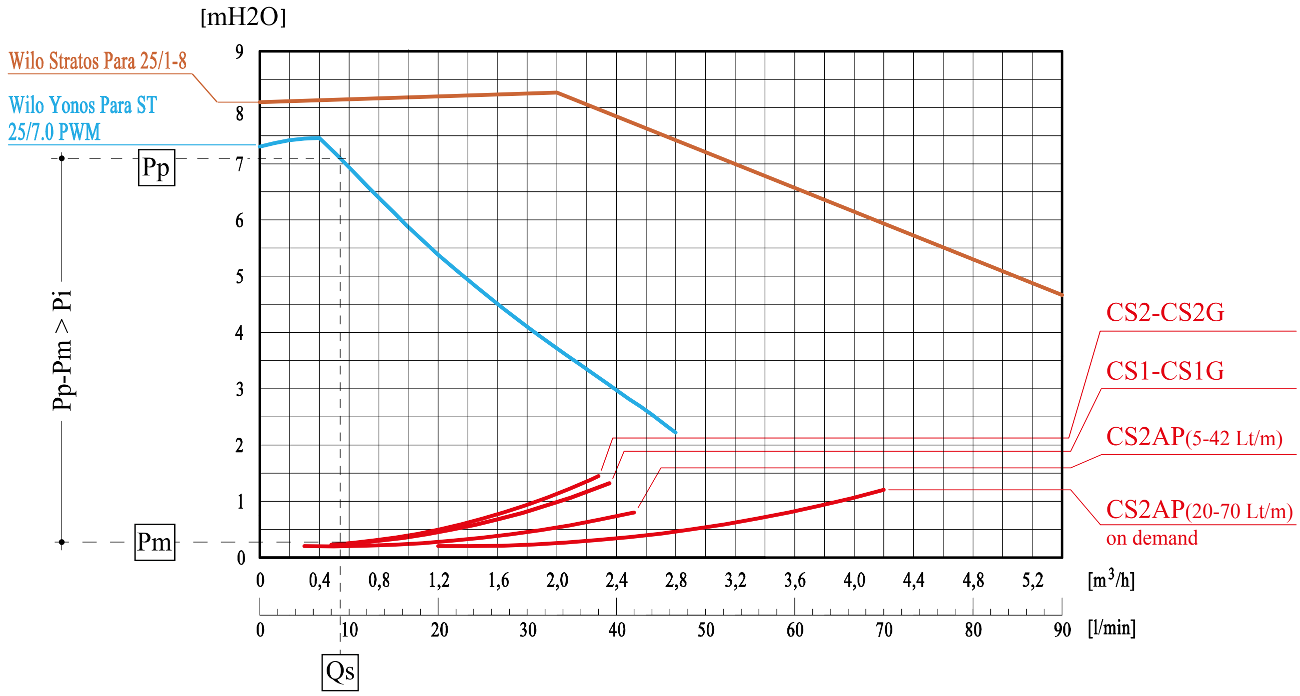
Pm: Loss of load determined by the chosen Solar Module;

Depending on the chosen module, the corresponding characteristic curve of the pump installed in it must be considered:

- For the CS1, CS1G, CS2, CS2G modules, the characteristic curve of the pump Wilo Yonos Para ST 25 / 7.0 PWM
- For the CS2AP module, the characteristic curve of the Wilo Stratos Para 25 / 1-8 pump

Depending on the chosen Solar Module and the considered flow rate (Qs), a more or less wide range of available pressure value is provided to overcome the load losses present on the plant.

Fig. 1 - Characteristic curves of modules and circulators



The condition to be respected it's the following:

$$Pi < (Pp - Pm)$$

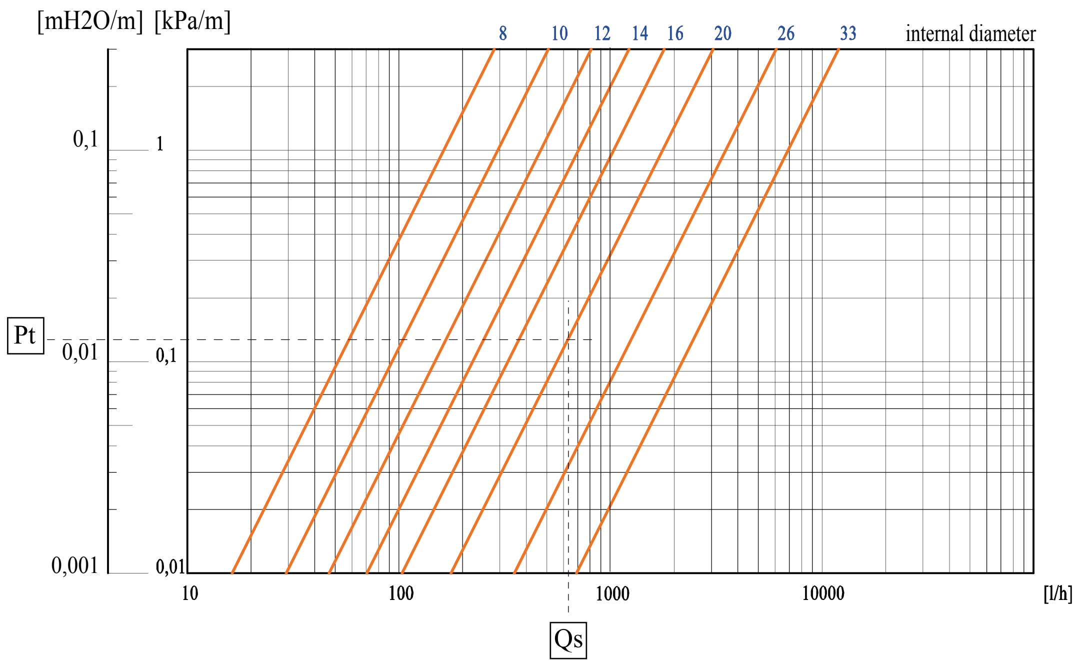
where Pi is the load loss on the system due to the sum of the load losses of all the components of the circuit, i.e.:

$$Pi = Pb + Pcs + 1.25 \times Pt + Pe$$

where:

- Pb: Loss of charge in the internal heat exchanger: it is available in the tables of the respective boilers, usually around 0.2-0.5 mH2O;
- Pcs: Load loss in the solar panel: usually about 0.075 sq.m. per 1 sq.m. Panel;
- Pt: Loss of load connected to both flow and return pipes present on the plant: easily determined by entering in the diagram of Fig. 2 with the inner diameter of the tubing used and with the flow Qs; take into account a 25% increase due to localized load losses;
- Pe: Load losses of any subsidiary device on the line other than those mentioned above.

Fig. 2 - Load losses in copper pipes



Calculation example:

Solar system characterized by:

- Solar circuit flow Qs = 9.0 Lt/min (540 Lt/h)
- N° 1 Boiler Mod. SFV00800R (Serpentine load loss Pb=0.25 mH2O with flow Qs=9 Lt/min);
- N° 6 panels Mod. PTML2.1AV (Total surface 6 x 2.1 Sq.m. = 12.6 Sq.m.);
- Solar module Mod. CS2G with a Wilo Yonos Para ST 25/7.0 PWM pump installed;
- Copper tubing Ø22 with Inner Diam. =20 mm;
- Tubing length=25 m (flow) + 25 m (return) = 50 m.

Pcs = 0 .075 [mH2O/Sq.m.] x 12.6 [Sq.m.] ≈ 0.95 mH2O;

with a flow rate Qs = 540 Lt/h and an inner Diam. = 20 mm, on the Fig. 2 graph a load loss value of 0.012 mH2O per tubing meter is obtained:

Pt = 0.012[mH2O/m] x 50[m] = 0.60 mH2O;

Pe=0;

Pi = Pb + Pcs + 1.25xPt + Pe = 0.25 + 0.95 + 1.25x0.50 ≈ 2 mH2O

Entering in the diagram of Fig. 1 with the flow Qs=9.0 Lt/min we can determine that:

Pp = 7.1 mH2O

Pm = 0.4 mH2O

Pi = 2 mH2O < Pp – Pm = 6.7 mH2O (...satisfied condition)

Using a Solar Module Mod. CS2G, the prevalence of the pump is higher than the total load losses present on the solar circuit and guarantees a safety margin of Pp - Pm - Pi = 4.7 mH2O.