

SAP



Manuale di istruzioni
Instruction manual
Bedienungsanleitung



L'installazione e la messa in opera del sistema **SAP** vanno effettuate esclusivamente da personale qualificato in accordo con i regolamenti nazionali e/o i relativi requisiti locali. Nel caso l'operatore debba effettuare interventi che comportano il pericolo di contatto con il fluido di caldaia, è opportuno che utilizzi i dispositivi di protezione individuale adeguati. È importante seguire attentamente le istruzioni fornite per prevenire danni al sistema e all'installatore.

Condizioni di utilizzo

Max temperatura operativa fluido primario: 110 °C
 Max pressione statica operativa: 10 bar
 Fluido primario: acqua/miscela acqua-glicole
 Fluido secondario: acqua sanitaria

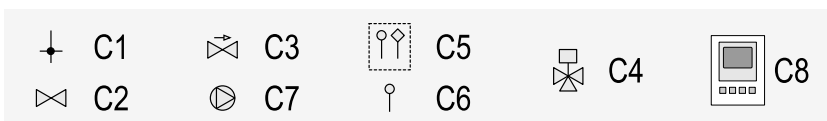
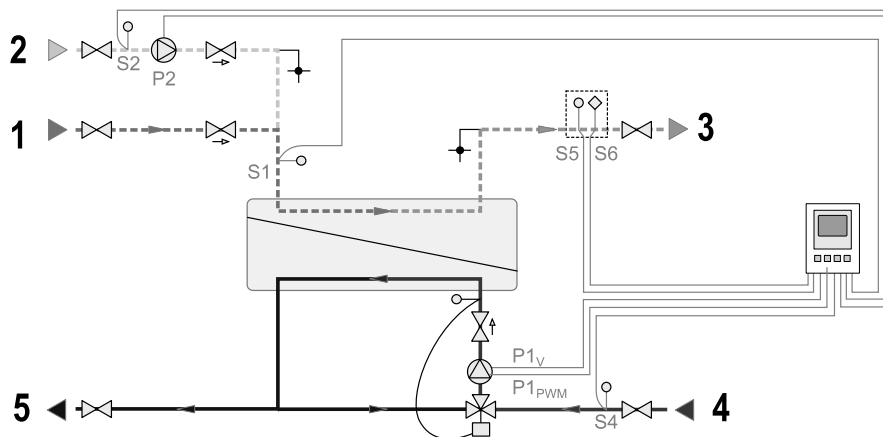
Materiali

Parti in ottone: CW617N
 Misuratore VFS: 2-40 l/min acciaio inox; 5-100 l/min PPA compatibile con acqua potabile
 Telaio: alluminio AW 5754
 Guscio di isolamento: polipropilene espanso
 Scambiatore di calore: piastre in acciaio inox, saldobrasate a rame puro
 Tubazioni: rame semicrudo
 O-ring e guarnizioni: EPDM perossidico

Descrizione e caratteristiche dei modelli

Funzionamento e schema operativo

Il modulo **SAP** è un sistema di riscaldamento per la preparazione istantanea di acqua calda sanitaria. Il circuito primario di **SAP** viene collegato ad un accumulatore inerziale scaldato da una o più fonti energetiche (solare, pompa di calore, termocamino, caldaia, ecc.). Quando sul secondario vi è richiesta di acqua calda sanitaria, il sensore di flusso e temperatura posto sull'uscita dell'acqua calda sanitaria comunica alla centralina i valori registrati istantaneamente e, se la temperatura è più bassa del valore di set-point impostato, essa fa partire la pompa primaria. La centralina inoltre modula la pompa primaria così da mantenere stabile la temperatura di uscita. Alcuni modelli di **SAP** sono dotati di valvola miscelatrice (SAP-...M...) per il controllo della temperatura di mandata primaria allo scambiatore di calore per mezzo di un comando termostatico regolabile 20-60 °C. Nei modelli dotati di circuito di ricircolo (SAP-...R...) la pompa di ricircolo è controllata direttamente dalla centralina a bordo e può essere gestito sulla base della richiesta o con una programmazione per fasce orarie. Lo schema operativo di **SAP** è riportato nella figura seguente.



- | | | | |
|-------|---|----|--|
| 1 | Ingresso acqua fredda sanitaria | S1 | Sonda temperatura ingresso acqua fredda sanitaria |
| 2 | Ingresso ricircolo ("R" in cod. prodotto) | S2 | Sonda temperatura ricircolo ("R" in cod. prodotto) |
| 3 | Uscita acqua calda sanitaria | S4 | Sonda temperatura acqua tecnica calda |
| 4 | Mandata calda acqua tecnica | S5 | Sensore temperatura uscita acqua calda sanitaria (VFS) |
| 5 | Ritorno freddo acqua tecnica | S6 | Sensore portata acqua calda sanitaria (VFS) |
| C1 | Rubinetto di carico/scarico | C5 | Sensore combinato flusso/temperatura (VFS) |
| C2 | Valvola di intercettazione | C6 | Sonda di temperatura |
| C3 | Valvola di ritegno | C7 | Circolatore |
| P1V | Alimentazione pompa primaria | C4 | Valvola miscelatrice ("M" in codice prodotto) |
| P1PWM | Segnale pompa primaria ("E" in codice prodotto) | C8 | Regolatore elettronico |
| P2 | Alimentazione pompa di ricircolo ("R" in cod. prodotto) | | |

Modelli disponibili

| COD. | Valvola miscelatrice | Ricircolo | N. piastre scambiatore | Circolatore primario | Pompa di ricircolo | Sensore VFS [l/min] |
|-----------|----------------------|-----------|------------------------|----------------------|--------------------|---------------------|
| SAP-35E | - | - | 20 | Yonos Para PWM 25/7 | - | 2-40 |
| SAP-45E | - | - | 30 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-60E | - | - | 50 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-80E | - | - | 50 | Stratos Para 25/1-8 | - | 5-100 |
| SAP-100E | - | - | 50 | Stratos Para 25/1-12 | - | 5-100 |
| SAP-35RE | - | ✓ | 20 | Yonos Para PWM 25/7 | ZRS 12/2 | 2-40 |
| SAP-45RE | - | ✓ | 30 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-60RE | - | ✓ | 50 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-80RE | - | ✓ | 50 | Stratos Para 25/1-8 | ZRS 12/6 | 5-100 |
| SAP-100RE | - | ✓ | 50 | Stratos Para 25/1-12 | ZRS 12/6 | 5-100 |

| COD. | Valvola miscelatrice | Ricircolo | N. piastre scambiatore | Circolatore primario | Pompa di ricircolo | Sensore VFS [l/min] |
|-----------|----------------------|-----------|------------------------|----------------------|--------------------|---------------------|
| SAP-30ME | ✓ | - | 20 | Yonos Para PWM 25/7 | - | 2-40 |
| SAP-40ME | ✓ | - | 30 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-50ME | ✓ | - | 50 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-70ME | ✓ | - | 50 | Stratos Para 25/1-8 | - | 5-100 |
| SAP-90ME | ✓ | - | 50 | Stratos Para 25/1-12 | - | 5-100 |
| SAP-30MRE | ✓ | ✓ | 20 | Yonos Para PWM 25/7 | ZRS 12/2 | 2-40 |
| SAP-40MRE | ✓ | ✓ | 30 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-50MRE | ✓ | ✓ | 50 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-70MRE | ✓ | ✓ | 50 | Stratos Para 25/1-8 | ZRS 12/6 | 5-100 |
| SAP-90MRE | ✓ | ✓ | 50 | Stratos Para 25/1-12 | ZRS 12/6 | 5-100 |

Tutti i circolatori primari dei **SAP** con "E" in codice prodotto sono conformi ai requisiti della direttiva ErP per il 2020. L'opzione con circolatore standard sul primario è disponibile solo nei paesi extraeuropei. In questo caso, Yonos Para 25/7, Stratos Para 25/1-8 e Stratos Para 25/1-12 sono sostituite rispettivamente da RS 25/6, Top S 25/8 e Top S 25/10 o circolatori equivalenti). Le caratteristiche idrauliche dei vari modelli sono riportate in Fig. 3 (lato primario) e Fig. 4 (lato secondario). Le curve dei circolatori elettronici e delle pompe di ricircolo sono riportate in Fig. 5.

Istruzioni di installazione

Preparazione del sistema

Consultare i disegni di Fig. 1 per dettagli su ingombri, filetti di attacco e interassi. Assicurarsi che le tubazioni portate a **SAP** siano compatibili con le sue caratteristiche. **SAP** deve essere alimentato a 230 VAC 50 Hz, ed è provvisto di spina tipo Schuko (tedesca) per la connessione diretta all'alimentazione.








Attenzione. Installare **SAP** quanto più vicino possibile all'accumulatore inerziale. I dati prestazionali riportati nel presente foglio istruzioni sono stati ricavati utilizzando un totale di 2 m di tubazione DN 25 per collegare il primario di **SAP** all'accumulatore. Qualsiasi incremento di lunghezza o diminuzione di diametro della tubazione di collegamento primaria riduce le potenzialità massime di **SAP** rispetto ai dati forniti nel seguito.

Montaggio pensile

Tutti i modelli di **SAP** possono essere facilmente installati a muro grazie alle quattro asole presenti sul telaio (v. dettagli A e B in Fig. 1). Si suggerisce di realizzare l'installazione mediante viti a tassello (non in dotazione). Prima di installare **SAP**, individuare la posizione di montaggio sul muro e segnare la posizione dei fori secondo quanto indicato in Fig. 1. Praticare i fori nel muro e inserirvi i tasselli. Appendere **SAP** e fissarlo saldamente con le rondelle e le viti.

Allacciamento alle tubazioni

Tagliare i tubi per portarli alla lunghezza necessaria. Realizzare il taglio in maniera netta e perpendicolare all'asse, avendo cura di non ovalizzare il tubo e di non lasciare bave o irregolarità. Fare riferimento a Fig. 2a e Fig. 2b per realizzare le connessioni alle tubazioni in maniera corretta. I simboli utilizzati hanno il seguente significato:

| | | | | |
|---|---|---|---|---|
|  |  |  |  |  |
| Prelievo da accumulatore (primario) | Ritorno all'accumulatore (primario) | Ingresso acqua fredda (sanitario) | Uscita acqua calda (sanitaria) | Ingresso ricircolo (sanitario) |

La connessione tra **SAP** e le tubazioni di mandata e ritorno primarie e secondarie possono essere realizzate mediante raccordi a stringere 1" M x DN e 1 1/4" x DN (ad esempio i raccordi IVAR art. RP 761 per tubo multistrato e RP 731 per tubo in polietilene) oppure raccordi a pressare 1" M x DN e 1 1/4" x DN (ad esempio i raccordi IVAR art. MP 5608 per tubo multistrato) per i collegamenti al circuito primario e secondario. La connessione al circuito di ricircolo può essere realizzata per mezzo di raccordi a stringere 3/4" M x DN (ad esempio i raccordi IVAR art. RP 761 per tubo multistrato e RP 731 per tubo in polietilene) oppure raccordi a pressare 3/4" M x DN (ad esempio i raccordi IVAR art. MP 5608 per tubo multistrato). Usare solo raccordi specifici per il tipo di tubo installato. Montare gli elementi del raccordo nell'ordine corretto e applicare le coppie di serraggio indicate dal costruttore per materiale e diametro dello specifico tubo installato. Nel caso di raccordi IVAR, si ricorda che è vietato lubrificare le parti in gomma con oli e grassi a base minerale e che è invece consigliabile usare solo acqua.

Collegamento elettrico



Attenzione. Qualsiasi intervento sui componenti elettrici ed elettronici di **SAP** deve essere eseguito da personale qualificato secondo le locali disposizioni di legge.

SAP viene fornito precablato. **SAP** va alimentato a 230 VAC ±10 %, 50...60 Hz, mediante il semplice collegamento della presa Schuko (tedesca) di cui è dotato.

Messa in funzione



Attenzione. Assicurarsi che le valvole a sfera di intercettazione siano tutte completamente aperte prima di mettere in funzione il produttore sanitario. La messa in servizio della centralina di controllo deve essere effettuata esclusivamente da personale qualificato per evitare di arrecare danno ai componenti dell'impianto e/o a cose e persone, secondo il libretto di istruzioni del regolatore allegato a **SAP**.

SAP comincia a funzionare non appena viene fornita alimentazione. Al primo avvio si renderà necessario effettuare la programmazione del regolatore, inserendo la temperatura di set-point per l'acqua calda sanitaria, la gestione del ricircolo, eventuali cicli di funzionamento speciali, ecc.: tale operazione va effettuata da un operatore qualificato secondo le istruzioni del regolatore allegate al modulo **SAP**. In particolare, verificare che la temperatura impostata sul regolatore per l'uscita di acqua calda sanitaria corrisponda all'effettiva temperatura di erogazione, leggendone il valore sull'apposito termometro.



Attenzione. Attenersi ai regolamenti locali per l'impostazione delle temperature di ingresso primario e di uscita secondaria.

I parametri corretti del circolatore primario sono impostati in fabbrica e non dovrebbero essere modificati dall'utente.

Manutenzione dello scambiatore

Si ricorda che le elevate temperature favoriscono la formazione di calcare sul secondario (acqua sanitaria) dello scambiatore di calore, per cui è consigliabile un controllo della durezza dell'acqua e una limitazione delle temperature di ingresso. In caso di acqua particolarmente dura e/o temperature troppo elevate, il lato sanitario dello scambiatore può essere soggetto a incrostazioni calcaree. In questo caso, il lato secondario dello scambiatore può essere lavato collegando un circuito esterno agli appositi rubinetti di carico (A) e scarico (B) mostrati in Fig. 6 e facendo circolare un liquido pulente all'interno dello scambiatore.

La scelta del fluido pulente dipende dal tipo di sporco e, per una pulizia ottimale, dovrebbe essere immesso a una portata almeno 1,5 volte superiore alla portata normale di funzionamento. Dopo la pulizia, lo scambiatore deve comunque essere risciacquato accuratamente con acqua pulita prima di effettuare nuovamente la connessione all'impianto di adduzione. Nel caso si rendesse necessario l'utilizzo di soluzioni acide, assicurarsi che il pH non sia inferiore a 2, e che eventuali residui vengano neutralizzati prima dell'ultimo risciacquo con acqua pulita. Se necessario, usare cartine di tornasole per verificare il pH all'uscita.

Prestazioni

Il numero presente nel codice prodotto di ogni **SAP** indica la taglia nominale del produttore, espressa in litri al minuto e ottenuta con ingresso primario a 60 °C e lato secondario (sanitario) 10-45 °C. Per esempio, SAP-45E è un modulo in grado di scaldare da 10 °C a 45 °C un massimo di 45 l/min di acqua sanitaria con un ingresso primario stabilmente a 60 °C. Per scegliere correttamente la taglia di **SAP**, è opportuno riferirsi alle tabelle di Fig. 8, che forniscono le prestazioni in termini di portata sanitaria massima riscaldabile da una certa temperatura di ingresso T2in a una certa temperatura di uscita T2out, avendo un ingresso primario a temperatura T1in. La legenda delle grandezze è riportata in Fig. 2b.



Attenzione. Nei moduli con valvola miscelatrice, la temperatura dell'acqua in ingresso al primario dello scambiatore è inferiore alla temperatura della caldaia o dell'accumulo, per effetto della miscelazione. Per usare correttamente le tabelle di Fig. 8, porre "T1in" uguale alla temperatura impostata sulla testa termostatica (acqua miscelata).



The installation and commissioning of the **SAP** unit must be exclusively performed by qualified personnel in accordance with the national guidelines and/or the relative local requirements. If the operator is required to perform any interventions which could pose a risk of direct contact with the boiler fluid, he/she is advised to use adequate personal protection equipment (PPE). It is important that the provided instructions be followed in order to avoid damage to the system and/or personal injury.

Conditions of use

Max primary fluid working temperature: 110 °C
 Max working static pressure: 10 bar
 Primary fluid: water or water/glycol mixtures
 Secondary fluid: drinking water

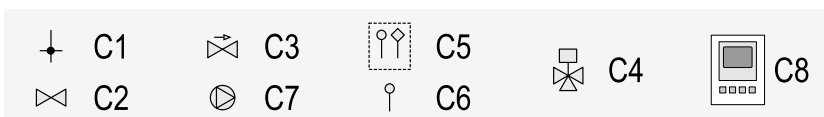
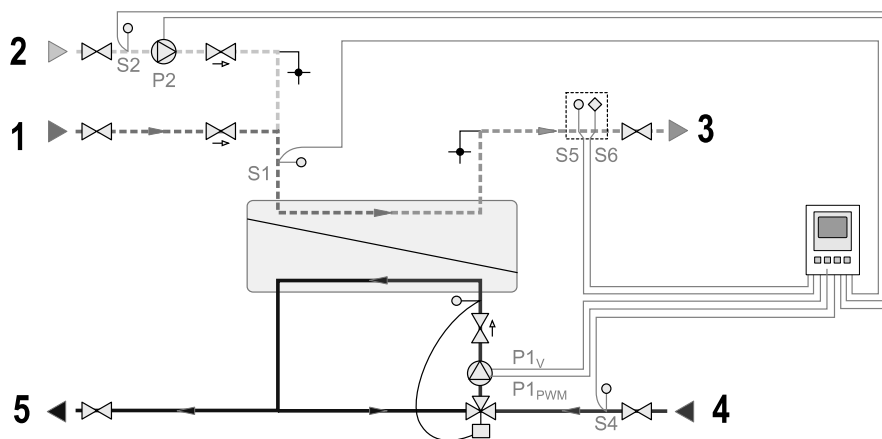
Materials

Brass parts: CW617N
 VFS: 2-40 l/min stainless steel; 5-100 l/min PPA compatible with drinking water
 Frame: aluminium AW 5754
 Insulation: expanded polypropylene
 Heat exchanger: pure-copper brazed stainless steel plates
 Pipes: half-hard copper
 O-rings and sealing parts: peroxide EPDM

Description and features

Operation and layout

SAP module is a heating unit for the instantaneous preparation of domestic hot water. **SAP**'s primary circuit is connected to a buffer tank, that can be heated up by different energy sources (solar circuit, heat pump, stove, boiler, etc.). When a DHW demand occurs, the combined flow and temperature sensor, located at the DHW outlet on **SAP**'s secondary side, sends the controller the instantaneous values detected: if flow temperature is lower than the prescribed set-point, the controller turns on the primary pump and modulates primary flow rate in order to keep the DHW temperature stable at the desired value. Some **SAP** models feature a mixing valve (SAP-...M...) to limit inlet primary flow temperature to the heat exchanger, by means of a thermostatic command 20-60 °C. In models equipped with recirculation circuit (SAP-...R...), recirculation pump is operated directly by the same on-board controller, based on request or on time periods. Schematic layout for **SAP** modules is reported in the following figure.



- | | |
|---|---|
| 1 Domestic cold water inlet | S1 Domestic cold water inlet temperature sensor |
| 2 Recirculation inlet ("R" in product code) | S2 Recirculation temperature sensor ("R" in product code) |
| 3 Domestic hot water outlet | S4 Hot boiler water temperature sensor |
| 4 Hot boiler water flow | S5 Domestic hot water outlet temperature sensor (VFS) |
| 5 Cold boiler water return | S6 Domestic hot water flow rate sensor (VFS) |
| C1 Fill/drain tap | C5 Combined flow/temperature sensor (VFS) |
| C2 Shut-off valve | C6 Temperature sensor |
| C3 Check valve | C7 Circulator pump |
| P1V Primary pump power supply | C4 Mixing valve ("M" in product code) |
| P1PWM Primary pump signal ("E" in product code) | C8 Electronic controller |
| P2 Recirculation pump relay ("R" in product code) | |

Available models

| COD. | Mixing valve | Recirculation | N. heat exchanger plates | Primary pump | Recirculation pump | VFS sensor [l/min] |
|-----------|--------------|---------------|--------------------------|----------------------|--------------------|--------------------|
| SAP-35E | - | - | 20 | Yonos Para PWM 25/7 | - | 2-40 |
| SAP-45E | - | - | 30 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-60E | - | - | 50 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-80E | - | - | 50 | Stratos Para 25/1-8 | - | 5-100 |
| SAP-100E | - | - | 50 | Stratos Para 25/1-12 | - | 5-100 |
| SAP-35RE | - | ✓ | 20 | Yonos Para PWM 25/7 | ZRS 12/2 | 2-40 |
| SAP-45RE | - | ✓ | 30 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-60RE | - | ✓ | 50 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-80RE | - | ✓ | 50 | Stratos Para 25/1-8 | ZRS 12/6 | 5-100 |
| SAP-100RE | - | ✓ | 50 | Stratos Para 25/1-12 | ZRS 12/6 | 5-100 |

| COD. | Mixing valve | Recirculation | N. heat exchanger plates | Primary pump | Recirculation pump | VFS sensor [l/min] |
|-----------|--------------|---------------|--------------------------|----------------------|--------------------|--------------------|
| SAP-30ME | ✓ | - | 20 | Yonos Para PWM 25/7 | - | 2-40 |
| SAP-40ME | ✓ | - | 30 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-50ME | ✓ | - | 50 | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-70ME | ✓ | - | 50 | Stratos Para 25/1-8 | - | 5-100 |
| SAP-90ME | ✓ | - | 50 | Stratos Para 25/1-12 | - | 5-100 |
| SAP-30MRE | ✓ | ✓ | 20 | Yonos Para PWM 25/7 | ZRS 12/2 | 2-40 |
| SAP-40MRE | ✓ | ✓ | 30 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-50MRE | ✓ | ✓ | 50 | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-70MRE | ✓ | ✓ | 50 | Stratos Para 25/1-8 | ZRS 12/6 | 5-100 |
| SAP-90MRE | ✓ | ✓ | 50 | Stratos Para 25/1-12 | ZRS 12/6 | 5-100 |

All the primary circulator pumps of **SAP** units featuring "E" in product code are compliant to the requirements of ErP directive 2020. The option with standard circulator pump on primary side is available only for extra-EU markets. In the latter case, Yonos Para 25/7, Stratos Para 25/1-8 and Stratos Para 25/1-12 are replaced by RS 25/6, Top S 25/8 and Top S 25/10 (or equivalent), respectively.

Hydraulic features for the different units are reported in Fig. 3 (primary side) and Fig. 4 (secondary side). Curves relative to electronic primary pumps and recirculation pumps are reported in Fig. 5.

Installation instructions

System set-up

See drawings in Fig. 1 for details on size, threads and clearances. Make sure the pipes to be connected to **SAP** are compatible with the module's fittings and with transported fluids. **SAP** must be supplied with 230 VAC 50 Hz power. The unit comes with Schuko (German) plug for direct plug-in.

Warning. Install **SAP** as close as possible to the buffer tank. Performance data in the present instruction sheet have been obtained considering overall 2 m piping, size DN 25, to connect **SAP**'s primary side to the buffer tank. Any increase in piping length or decrease in piping diameter reduces maximum **SAP** performances with respect to declared values.

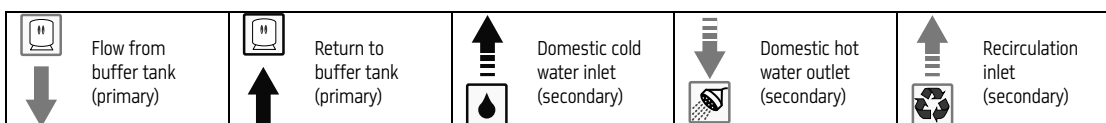
Wall mounting

SAP units can be easily wall mounted thanks to the dedicated holes on the metal frame (see details A and B in Fig. 1). It is recommended that the unit is hung by means of screw anchors (not included). Before installing **SAP**, identify the desired position on the wall and mark the anchor position according to the indications in Fig. 1. Drill the holes into the wall and slide the expansion anchors into them. Firmly secure **SAP** on the wall with washers and support screws.

Plumbing operations

Warning. Cut the pipes to the correct size. Make a clean cut perpendicular to the pipe axis, making sure not to ovalise the pipe or leave burrs or irregularities.

Refer to Fig. 2a and Fig. 2b to correctly perform the connection to the pipes. Symbols used have the following meaning:



The connection between **SAP** and primary and secondary pipes can be performed through 1 1/4" M x DN and 1" M x DN screw fittings (such as IVAR fittings art. RP 761 for multilayer pipe and RP 731 for polyethylene pipe) or 1 1/4" M x DN and 1" M x DN press fittings (such as IVAR fittings art. MP 5608 for multilayer pipe). The connection to the recirculation circuit can be performed by means of 3/4" M x DN screw fittings (such as IVAR fittings art. RP 761 for multilayer pipe and RP 731 for polyethylene pipe) or 3/4" M x DN press fittings (such as IVAR fittings art. MP 5608 for multilayer pipe). Use only fittings that are suitable to the specific pipe. Mount fitting elements in the correct order, and apply the tightening torque indicated by the manufacturer for the specific pipe material and diameter. In case of IVAR fittings, rubber parts cannot be lubricated with mineral-based oil or grease and the use of water alone is strongly recommended.

Electrical operations

Warning. According to local regulations, it may be necessary to ground **SAP** aluminium frame. Any intervention on electric and electronic components must be performed by qualified personnel according to the local laws.

SAP comes pre-wired. **SAP** must be supplied with 230 VAC ±10 %, 50...60 Hz power, by simply plugging in the Schuko (German) plug **SAP** comes equipped with.

Start-up

Warning. Make sure all the shut-off ball valves are fully open before operating the fresh water station. The set-up of the controller must be performed exclusively by qualified personnel in order to prevent damages to the system and/or personal injury, according to the instruction manual included in **SAP** package.

SAP starts working as soon as it gets power-supplied. At the first start up, the controller must be set-up by entering the desired domestic hot water set-point, recirculation management, possible special operation cycles, etc. Such operation must be performed by qualified personnel according to the instruction manual included in **SAP** package. Check that the domestic hot water set-point temperature entered into the controller corresponds to the actual outlet temperature, by reading its value on the dedicated thermometer.

Warning. Choose secondary outlet set-point temperature so to comply with any possible local regulations.

Circulator and recirculation pumps parameters are factory-setting and should not be changed by the user.

Heat exchanger maintenance

It is worth reminding that high temperature promotes the formation of limestone on the secondary (domestic water) side of the heat exchanger. Therefore, water hardness should be checked and limited, as well as primary side inlet temperature. In case of particularly hard water or high temperature, the secondary side may be partially blocked by calcium formation. In this case, the secondary side of the heat exchanger can be washed by fitting a circuit to the proper filling (A) and draining (B) taps (see Fig. 6) and circulating a washing liquid through the heat exchanger. The choice of the cleaning liquid depends on the fouling type. For a proper cleaning, the fluid flow rate should be at least 1.5 times the ordinary working flow rate. After being cleaned, the heat exchanger should be accurately rinsed with clean water before connecting it back to the plant. In case the use of acid solutions is strictly necessary, make sure pH is not lower than 2, and that possible remaining acid is completely neutralised before the last rinsing with clean water. Use litmus paper to check pH at the outlet, if necessary.

Performance

The number included in **SAP**'s product code indicates the nominal performance of the station expressed in litres per minute, obtained with primary inlet at 60 °C and secondary side 10-45 °C. For example, SAP-45E unit can prepare up to 45 l/min domestic water, 10 °C to 45 °C, when the primary boiler flow is steadily at 60 °C.

Tables in Fig. 8 can be used to choose the most suitable **SAP** size. Such tables provide performances in terms of maximum domestic water flow rate that can be heated up (T2in → T2out), when primary inlet is at T1in. Key to fundamental quantities is reported in Fig. 2b.



Warning. In units equipped with mixing valve, the actual temperature of heating water to the heat exchanger primary inlet is lower than boiler/buffer tank temperature, as a consequence of mixing. To use tables in Fig. 8 properly, choose "T1in" value corresponding to the thermostatic head setting (mixed water).



Die Installation und Inbetriebnahme des **SAP**-Systems darf ausschließlich von qualifiziertem Personal entsprechend der nationalen Vorschriften bzw. örtlich geltender Bestimmungen durchgeführt werden. Sind Arbeiten erforderlich, bei denen Berührungsgefahr mit dem Kesselmedium besteht, sollte die entsprechende persönliche Schutzausrüstung verwendet werden. Die Anweisungen und Hinweise müssen beachtet werden, um etwaige Sach- und Personenschäden zu verhindern.

Einsatzbedingungen

Max. Betriebstemperatur Primärmedium: 110 °C
 Max. statischer Betriebsdruck: 10 bar
 Primärmedium: Wasser / Wasser-Glykol-Gemisch
 Sekundärmedium: Trinkwasser

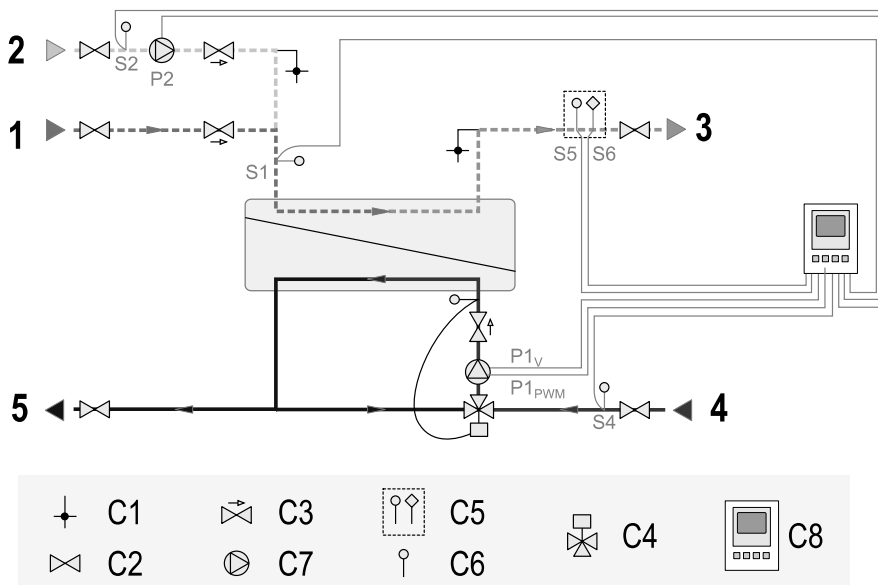
Materialien

Messingteile: CW617N
 VFS-Messer: 2 – 40 l/min Edelstahl; 5 – 100 l/min PPA, geeignet für Trinkwasser
 Rahmen: Aluminium AW 5754
 Dämmschale: Polypropylenschaum
 Wärmetauscher: Plattentauscher, mit reinem Kupfer hartverlötet
 Rohrleitungen: Hartkupfer
 O-Ringe und Dichtungen: peroxidisch vernetztes EPDM

Beschreibung und Merkmale der Modelle

Funktion und Betriebsweise

Das **SAP**-Modul ist eine Heizungsanlage zur direkten Warmwasserbereitung. Der Primärkreislauf des **SAP**-Moduls ist mit einem Pufferbehälter verbunden, der über eine oder mehrere Energiequellen (Solar, Wärmepumpe, Kamin, Heizkessel, usw.) erhitzt wird. Bei der sekundärseitigen Bedarfsanforderung nach Warmwasser übermittelt der Durchfluss- und Temperatursensor am Warmwasserausgang der Steuerung die Ist-Werte in Echtzeit, welche bei Unterschreiten der eingestellten Solltemperatur die Primärpumpe startet. Die Steuerung moduliert außerdem die Primärpumpe, um eine stabile Ausgangstemperatur zu gewährleisten. Einige **SAP**-Modelle sind mit einem Mischventil (SAP-...M...) zur Regelung der primärseitigen Vorlauftemperatur zum Wärmetauscher über einen (20 – 60 °C) einstellbaren Thermostatregler ausgestattet. Bei den Modellen mit Zirkulationskreislauf (SAP-...R...) wird die Zirkulationspumpe direkt über die integrierte Steuerung geregelt, welche nach Bedarf oder über Zeitschaltuhr gesteuert werden kann. Das **SAP**-Betriebsschema wird in der folgenden Abbildung dargestellt.



| | | | |
|-------|--|----|---|
| 1 | Eintritt Kaltwasser | S1 | Temperaturfühler Eintritt Kaltwasser |
| 2 | Eintritt Zirkulation („R“ in Produktcode) | S2 | Temperaturfühler Zirkulation („R“ in Produktcode) |
| 3 | Austritt Warmwasser | S4 | Temperaturfühler Heizung |
| 4 | Vorlauf Heizung | S5 | Temperaturfühler Austritt Warmwasser (VFS) |
| 5 | Rücklauf Heizung | S6 | Durchflussmesser Warmwasser (VFS) |
| C1 | Füll-/Entleerhahn | C5 | Kombinierter Durchfluss-/Temperaturfühler (VFS) |
| C2 | Absperrventil | C6 | Temperaturfühler |
| C3 | Rückschlagventil | C7 | Umwälzpumpe |
| P1V | Stromversorgung Primärpumpe | C4 | Mischventil („M“ im Produktcode) |
| P1PWM | Signal Primärpumpe („E“ im Produktcode) | C8 | Elektronischer Regler |
| P2 | Stromversorgung Umwälzpumpe („R“ in Produktcode) | | |

Verfügbare Modelle

| COD. | Mischventil | Zirkulation | Plattenanzahl | Wärmetauscher | Umwälzpumpe Primärseite | Umwälzpumpe | VFS-Sensor [l/min] |
|-----------|-------------|-------------|---------------|---------------|-------------------------|-------------|--------------------|
| SAP-35E | - | - | 20 | | Yonos Para PWM 25/7 | - | 2-40 |
| SAP-45E | - | - | 30 | | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-60E | - | - | 50 | | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-80E | - | - | 50 | | Stratos Para 25/1-8 | - | 5-100 |
| SAP-100E | - | - | 50 | | Stratos Para 25/1-12 | - | 5-100 |
| SAP-35RE | - | ✓ | 20 | | Yonos Para PWM 25/7 | ZRS 12/2 | 2-40 |
| SAP-45RE | - | ✓ | 30 | | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-60RE | - | ✓ | 50 | | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-80RE | - | ✓ | 50 | | Stratos Para 25/1-8 | ZRS 12/6 | 5-100 |
| SAP-100RE | - | ✓ | 50 | | Stratos Para 25/1-12 | ZRS 12/6 | 5-100 |
| COD. | Mischventil | Zirkulation | Plattenanzahl | Wärmetauscher | Umwälzpumpe Primärseite | Umwälzpumpe | VFS-Sensor [l/min] |
| SAP-30ME | ✓ | - | 20 | | Yonos Para PWM 25/7 | - | 2-40 |
| SAP-40ME | ✓ | - | 30 | | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-50ME | ✓ | - | 50 | | Yonos Para PWM 25/7 | - | 5-100 |
| SAP-70ME | ✓ | - | 50 | | Stratos Para 25/1-8 | - | 5-100 |
| SAP-90ME | ✓ | - | 50 | | Stratos Para 25/1-12 | - | 5-100 |
| SAP-30MRE | ✓ | ✓ | 20 | | Yonos Para PWM 25/7 | ZRS 12/2 | 2-40 |
| SAP-40MRE | ✓ | ✓ | 30 | | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-50MRE | ✓ | ✓ | 50 | | Yonos Para PWM 25/7 | ZRS 12/2 | 5-100 |
| SAP-70MRE | ✓ | ✓ | 50 | | Stratos Para 25/1-8 | ZRS 12/6 | 5-100 |
| SAP-90MRE | ✓ | ✓ | 50 | | Stratos Para 25/1-12 | ZRS 12/6 | 5-100 |

Alle Umwälzpumpen der **SAP**-Module mit „E“ im Produktcode erfüllen die Anforderungen der ErP-Richtlinie für das Jahr 2020. Die Option mit primärseitiger Standard-Umwälzpumpe steht nur außerhalb Europas zur Verfügung. In diesem Fall werden Yonos Para 25/7, Stratos Para 25/1-8 und Stratos Para 25/1-12 jeweils durch RS 25/6, Top S 25/8 und Top S 25/10 oder gleichwertige Umwälzpumpen ersetzt). Die hydraulischen Eigenschaften der verschiedenen Modelle sind in Fig. 3 (Primärseite) und Fig. 4 (Sekundärseite) dargestellt. Die Kennlinien der elektronischen und normalen Umwälzpumpen sind in Fig. 5 dargestellt.

Installationsanleitung

Vorbereitung der Anlage

Für Details zu Abmessungen, Anschlussgewinde und Achsabstände wird auf die Zeichnungen der Fig. 1 verwiesen. Sicherstellen, dass die Zuleitungen zum **SAP**-Modul mit dessen Eigenschaften kompatibel sind. Das **SAP**-Modul muss mit 230 VAC 50 Hz versorgt werden und ist mit einem Schuko-Stecker für den direkten Netzanschluss ausgestattet.








Achtung. Das **SAP**-Modul muss so nah wie möglich am Speicherbehälter installiert werden. Die in diesem Anleitungsblatt angegebenen Leistungsdaten wurden unter Verwendung einer 2 m Verbindungsleitung DN25 zwischen Primärseite des **SAP**-Moduls und Pufferbehälter ermittelt. Jede Vergrößerung der Länge oder Verkleinerung des Durchmessers der Primärleitung verursacht eine Leistungsminderung des **SAP**-Moduls gegenüber den nachfolgenden Daten.

Wandmontage

Alle **SAP**-Modelle können Dank der vier Aussparungen im Rahmen problemlos an der Wand montiert werden (siehe Details A und B in Fig. 1). In diesem Fall wird die Installation mit Dübelschrauben empfohlen (nicht mitgeliefert). Vor der Installation des **SAP**-Moduls die Montageposition an der Wand festlegen und die Bohrpositionen gemäß Fig. 1 markieren. Die Löcher bohren und die Dübel einsetzen. Das **SAP**-Modul ansetzen und sicher mit Unterlegscheiben und Schrauben fixieren.

Anschluss der Rohrleitungen

Die Rohre auf die erforderliche Länge abschneiden. Einen sauberen und rechtwinkligen Schnitt ausführen, darauf achten, dass das Rohr nicht abgeflacht wird und alle Grate oder Unregelmäßigkeiten entfernen. Siehe Fig. 2a und Fig. 2b für die korrekte Ausführung der Anschlüsse. Die verwendeten Symbole haben folgende Bedeutung:

| | | | | | | | | | |
|---|---------------------------------------|---|---------------------------------------|---|-----------------------------------|--|-----------------------------------|---|------------------------------------|
|  | Vorlauf von Speicherbehälter (Primär) |  | Rücklauf zu Speicherbehälter (Primär) |  | Eintritt Kaltwasser (Trinkwasser) |  | Austritt Warmwasser (Trinkwasser) |  | Eintritt Zirkulation (Trinkwasser) |
|---|---------------------------------------|---|---------------------------------------|---|-----------------------------------|--|-----------------------------------|---|------------------------------------|

Die Verbindung zwischen **SAP**-Modul und primärseitigen Vor- und Rücklauf können mittels Quetschverschraubungen 1" AG x DN und 1 1/4" x DN (z. B. Verschraubungen IVAR Art. RP 761 für Mehrschichtverbundrohr und RP 731 für PE-Rohr) ausgeführt werden, oder mit Pressfittings 1" AG x DN und 1 1/4" x DN (z. B. Fittings IVAR Art. MP 5608 für Mehrschichtverbundrohr) für die Anschlüsse der Primär- und Sekundärkreise. Die Verbindung an die Zirkulationsleitung kann mittels Quetschverschraubungen 3/4" AG x DN (z. B. Verschraubungen IVAR Art. RP 761 für Mehrschichtverbundrohr und RP 731 für PE-Rohr) oder mit Pressfittings 3/4" AG x DN (z. B. Fittings IVAR Art. MP 5608 für Mehrschichtverbundrohr) ausgeführt werden. Es dürfen nur die spezifischen Fittings für den verwendeten Rohrtyp eingesetzt werden. Die Komponenten der Fittings in der richtigen Reihenfolge montieren und das vom Hersteller angegebene Drehmoment für das verwendete Material und Rohrdurchmesser anwenden. Bei der Verwendung von IVAR-Fittings wird daran erinnert, dass es verboten ist, die Gummiteile mit Ölen und Fetten auf Mineralölbasis zu schmieren, und empfohlen wird, nur Wasser zu verwenden.

Elektrischer Anschluss



Achtung. Alle Arbeiten an elektrischen und elektronischen Komponenten der **SAP**-Module müssen von Fachpersonal entsprechend den geltenden gesetzlichen Vorschriften durchgeführt werden.

Die **SAP**-Module werden vorverdrahtet geliefert. Die **SAP**-Module erfordern eine 230 VAC ±10 %, 50...60 Hz Versorgung, der Anschluss erfolgt über den vorgesehenen Schuko-Stecker.

Inbetriebnahme



Achtung. Vor Inbetriebnahme des Warmwasserbereiters sicherstellen, dass die Absperrkugelhähne vollständig geöffnet sind. Die Inbetriebnahme der Steuerung muss durch Fachpersonal entsprechend der beiliegenden Steuerungsanleitung erfolgen, um Schäden an Anlagenteilen oder Gegenständen bzw. Verletzungen zu vermeiden.

Das **SAP**-Modul nimmt sofort nach Herstellung der Stromversorgung den Betrieb auf. Die Steuerung muss bei der ersten Inbetriebnahme programmiert werden, hierzu gehört die Eingabe des Temperatursollwerts für Warmwasser, die Schaltpunkte der Zirkulation, eventuelle besondere Betriebszyklen, usw.. Dieser Arbeitsschritt muss von Fachpersonal entsprechend der beiliegenden Steuerungsanleitung durchgeführt werden. Insbesondere muss anhand des entsprechenden Thermometers geprüft werden, dass die am Warmwasser-Temperaturregler eingestellte Temperatur der tatsächlichen Austrittstemperatur entspricht.



Achtung. Es müssen die lokalen Vorschriften für die Einstellung der primärseitigen Eintrittstemperatur und der sekundärseitigen Austrittstemperatur beachtet werden.

Die korrekten Parameter der Primärpumpe sind werkseitig eingestellt und sollten vom Anwender nicht geändert werden.

Wartung des Wärmetauschers

Es wird daran erinnert, dass hohe Temperaturen die Bildung von Kalkablagerungen auf der Sekundärseite (WW) des Wärmetauschers begünstigen, daher sollte die Wasserhärte kontrolliert und die Eintrittstemperatur begrenzt werden. Bei besonders hartem Wasser und/oder zu hohen Temperaturen kann die Warmwasserseite des Wärmetauschers verkalken. In diesem Fall kann die Sekundärseite des Wärmetauschers durch Anschluss eines externen Kreislaufs an die entsprechend Füll- (A) und Entleerungshähne (B) gemäß Fig. 6 mit einer Reinigungsflüssigkeit gespült werden.

Die verwendete Reinigungsflüssigkeit hängt von der Art der Verschmutzung ab, für eine optimale Reinigung sollte die Durchflussmenge mindestens 1,5-mal höher als der normale Betriebsdurchfluss sein. Nach der Reinigung muss der Wärmetauscher immer gründlich mit sauberem Wasser gespült werden, bevor der erneute Anschluss an das Versorgungsnetz erfolgt. Sollte die Verwendung von sauren Lösungen erforderlich sein, muss sichergestellt werden, dass der pH-Wert nicht weniger als 2 beträgt und dass alle Rückstände vor der letzten Spülung mit sauberem Wasser neutralisiert werden. Falls erforderlich pH-Messstreifen verwenden, um den pH-Wert am Austritt zu messen.

Leistungsdaten

Die Zahl im Produktcode jedes **SAP**-Moduls gibt die Nenngröße des Erzeugers in Litern pro Minute an, die mit primärseitiger Zulauftemperatur 60 °C und sekundärseitiger Temperatur (Trinkwasser) 10 – 45 °C erreicht werden. Beispielsweise ist SAP-45E ein Modul, das max. 45 l/min Wasser von 10 °C auf 45 °C bei einer stabilen primärseitigen Zulauftemperatur von 60 °C erzeugt. Um die richtige Größe des **SAP**-Moduls zu wählen, sollte die Tabelle in Fig. 8 beachtet werden, die die Leistungswerte der maximalen Warmwassermenge bei einer bestimmten Eintrittstemperatur T_{2in} und einer bestimmten Austrittstemperatur T_{2out}, mit einer primärseitigen Vorlauftemperatur T_{1in} darstellt. Die Einheitenlegende ist in Fig. 2b dargestellt.



Achtung. Bei Modulen mit Mischventil ist die primärseitige Vorlauftemperatur des Wärmetauschers durch die Mischwirkung niedriger als die Temperatur des Kessels oder des Speicherbehälters. Für die korrekte Verwendung der Tabellen der Fig. 8 muss die am Thermostatkopf (Mischwasser) eingestellte Temperatur für „T_{1in}“ gewählt werden.

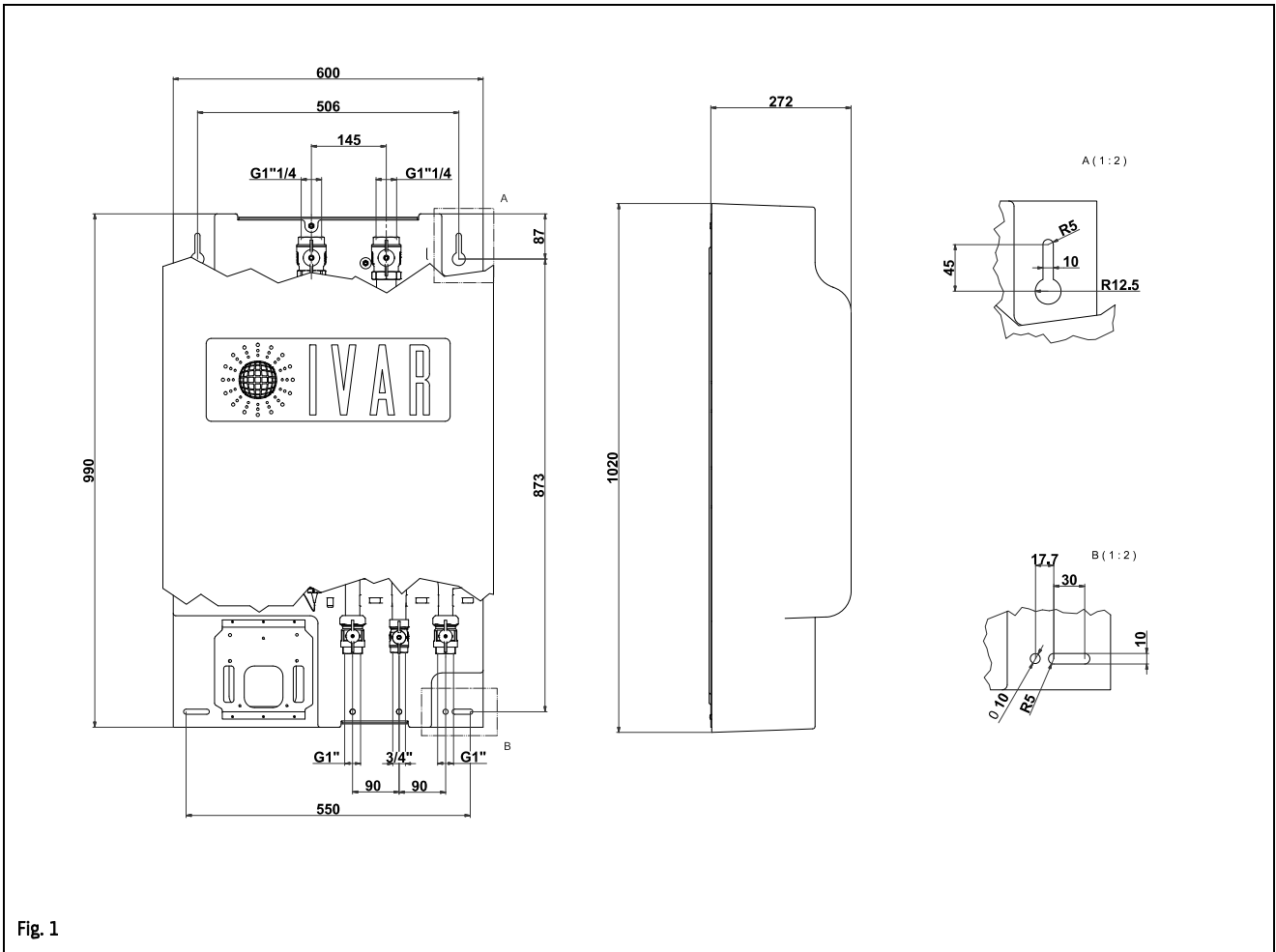
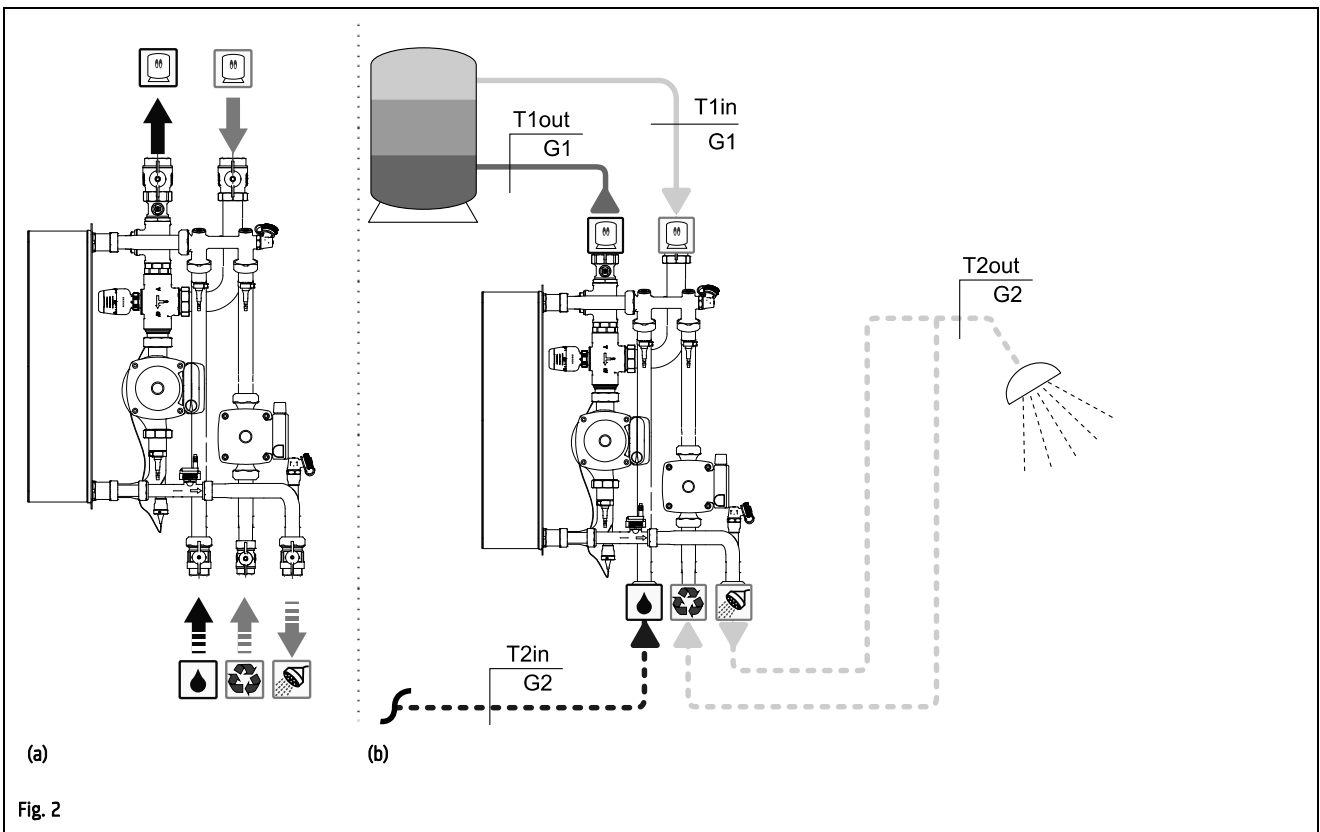


Fig. 1



(a)

(b)

Fig. 2

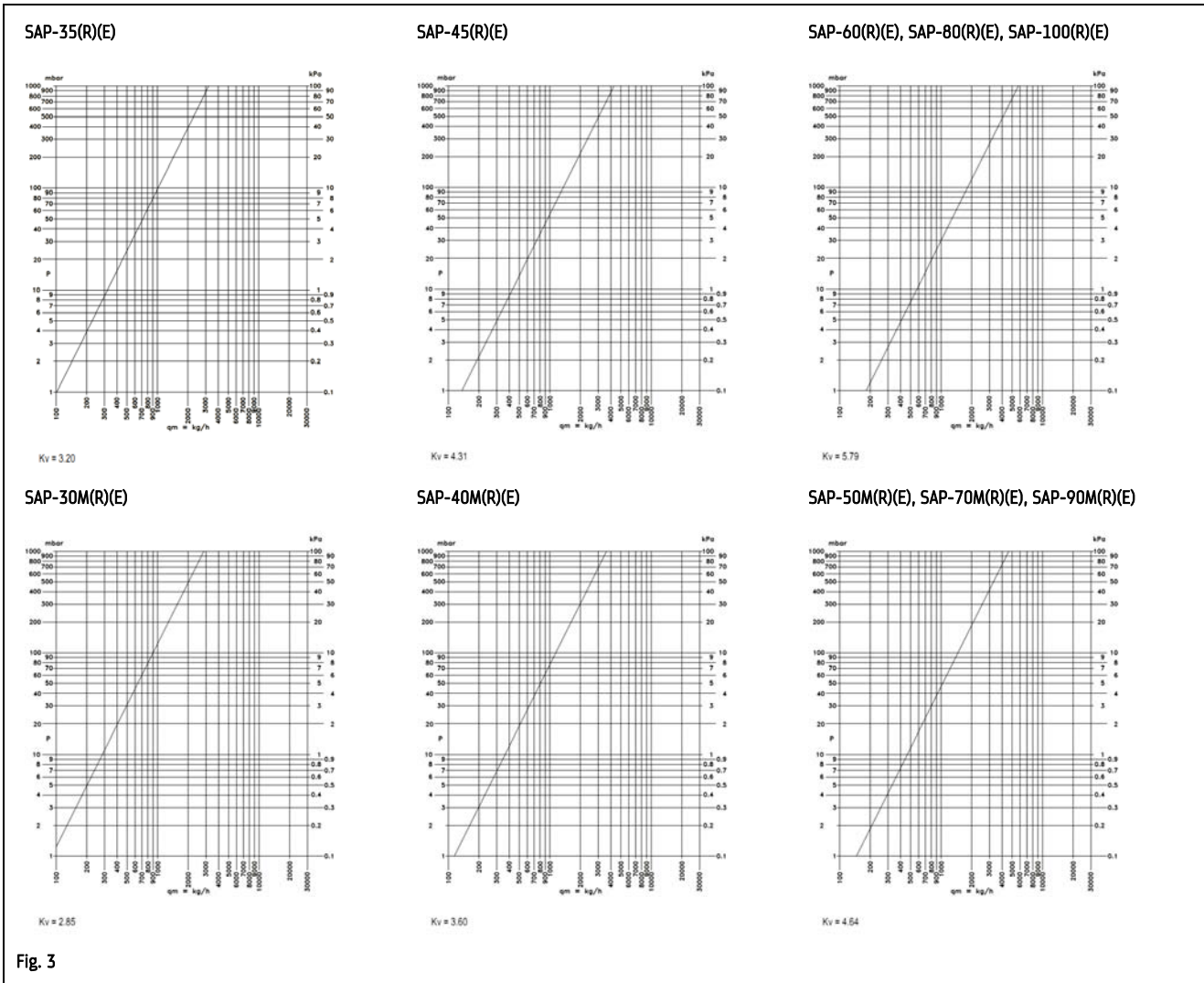


Fig. 3

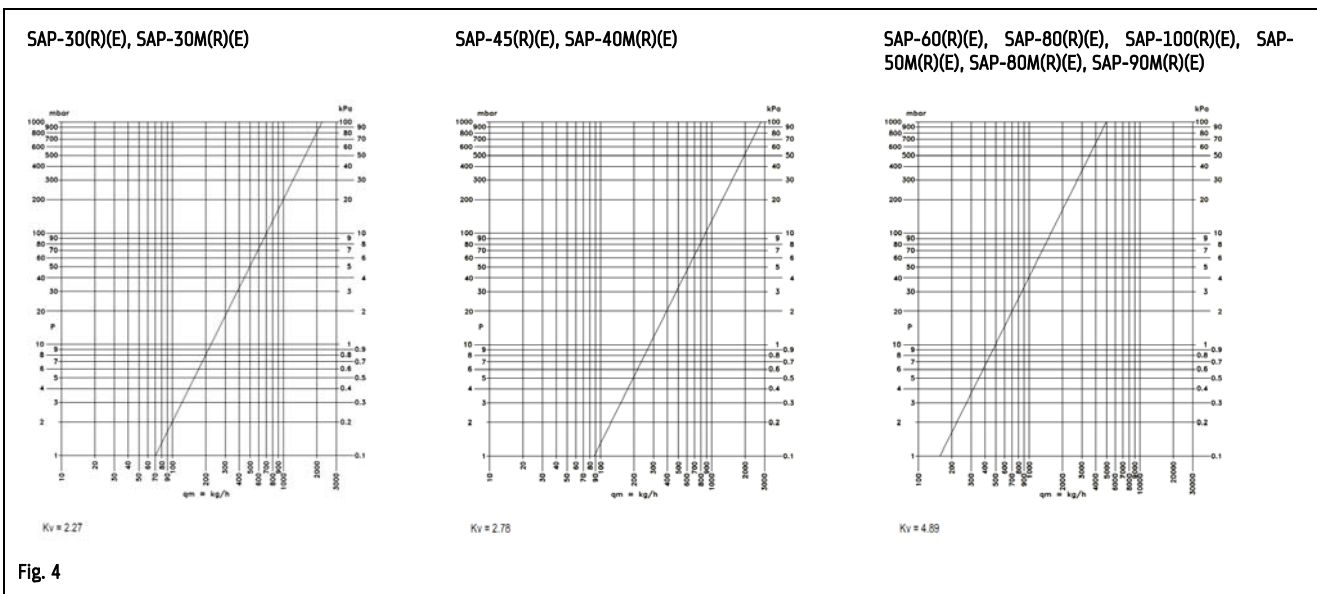


Fig. 4

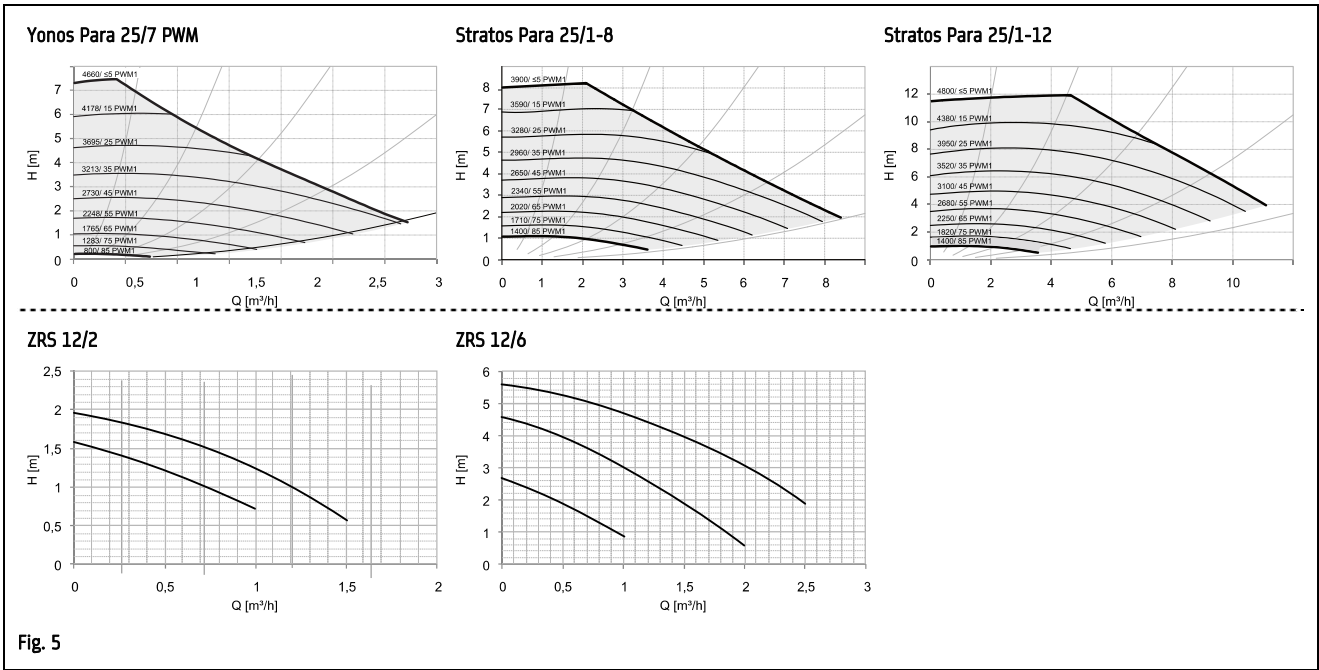


Fig. 5

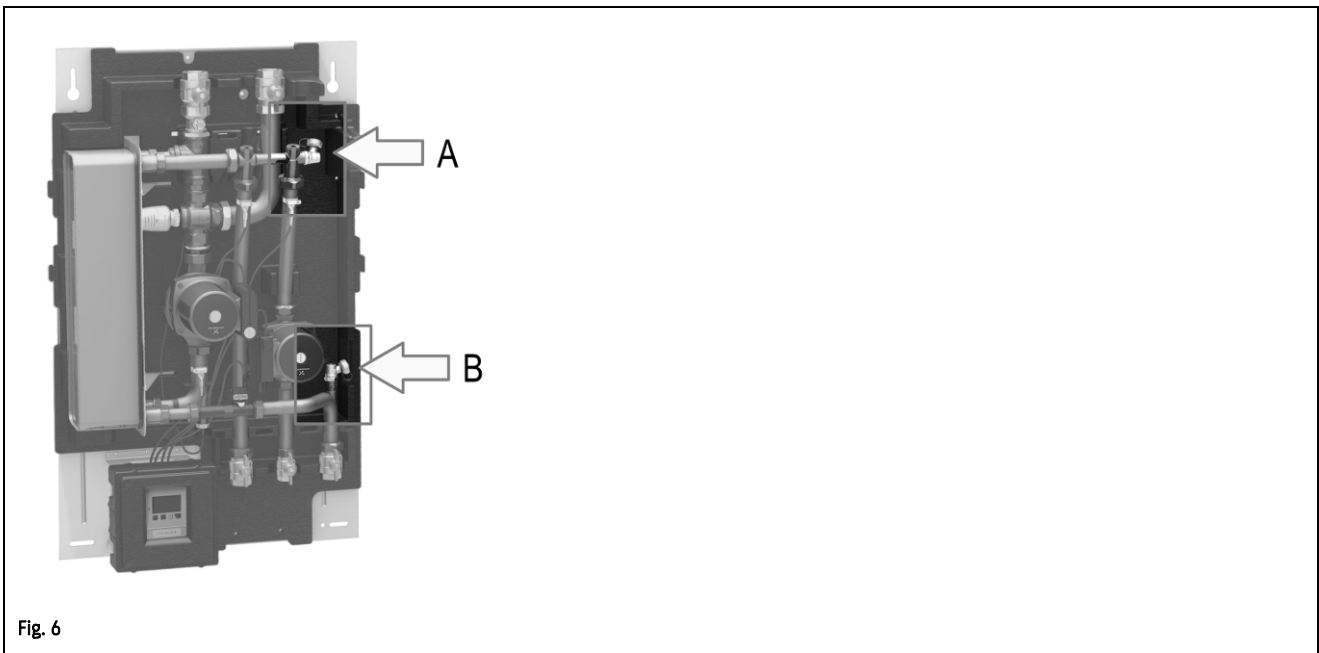


Fig. 6

SAP-35E/SAP-35RE

| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | | | | | | | | | |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | 45 | | 50 | | 55 | | 60 | | 65 | | 70 | | 75 | | 80 | | 85 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 22.0 | 21.4 | 29.5 | 18.2 | 36.0 | 16.3 | 41.9 | 15.0 | 47.5 | 14.0 | 52.9 | 13.2 | 58.2 | 12.5 | 63.4 | 11.9 | 68.5 | 11.5 |
| | 45 | - | - | 21.2 | 24.0 | 28.2 | 20.4 | 34.0 | 18.2 | 39.4 | 16.7 | 44.4 | 15.5 | 49.2 | 14.5 | 54.0 | 13.8 | 58.6 | 13.1 |
| | 50 | - | - | - | - | 20.6 | 26.5 | 27.1 | 22.5 | 32.5 | 20.1 | 37.4 | 18.4 | 42.0 | 17.0 | 46.4 | 15.9 | 50.7 | 15.0 |
| | 60 | - | - | - | - | - | - | - | - | 19.8 | 31.6 | 25.6 | 26.9 | 30.3 | 23.9 | 34.5 | 21.8 | 38.5 | 20.1 |
| 10 | 40 | 23.6 | 23.3 | 32.0 | 20.6 | 39.1 | 18.9 | 45.8 | 17.8 | 52.1 | 17.0 | 58.3 | 16.3 | 64.3 | 15.8 | 70.2 | 15.3 | 76.1 | 15.0 |
| | 45 | - | - | 22.5 | 25.8 | 30.1 | 22.6 | 36.5 | 20.8 | 42.4 | 19.4 | 48.0 | 18.4 | 53.4 | 17.6 | 58.7 | 17.0 | 63.9 | 16.4 |
| | 50 | - | - | - | - | 21.7 | 28.3 | 28.7 | 24.7 | 34.6 | 22.6 | 39.9 | 21.1 | 44.9 | 19.9 | 49.8 | 19.0 | 54.4 | 18.2 |
| | 60 | - | - | - | - | - | - | - | - | 20.6 | 33.4 | 26.7 | 29.0 | 31.8 | 26.3 | 36.3 | 24.4 | 40.5 | 22.9 |
| 15 | 40 | 25.6 | 25.3 | 35.1 | 23.0 | 43.3 | 21.7 | 51.0 | 20.9 | 58.4 | 20.2 | 65.6 | 19.7 | 72.6 | 19.3 | 79.6 | 18.9 | 86.5 | 18.7 |
| | 45 | - | - | 24.1 | 27.8 | 32.5 | 25.1 | 39.7 | 23.5 | 46.3 | 22.4 | 52.7 | 21.5 | 58.8 | 20.9 | 64.8 | 20.4 | 70.7 | 19.9 |
| | 50 | - | - | - | - | 23.0 | 30.3 | 30.6 | 27.1 | 37.1 | 25.2 | 42.9 | 23.9 | 48.5 | 22.9 | 53.9 | 22.2 | 59.2 | 21.5 |
| | 60 | - | - | - | - | - | - | - | - | 21.6 | 35.2 | 28.1 | 31.2 | 33.5 | 28.8 | 38.3 | 27.1 | 42.9 | 25.8 |

SAP-45E/SAP-45RE

| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | | | | | | | | | |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | 45 | | 50 | | 55 | | 60 | | 65 | | 70 | | 75 | | 80 | | 85 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 28.6 | 19.5 | 37.8 | 16.4 | 45.6 | 14.5 | 52.7 | 13.1 | 59.4 | 12.1 | 65.9 | 11.4 | 72.2 | 10.7 | 78.4 | 10.2 | 84.6 | 9.8 |
| | 45 | - | - | 27.7 | 21.9 | 36.1 | 18.3 | 43.2 | 16.1 | 49.6 | 14.6 | 55.6 | 13.4 | 61.5 | 12.5 | 67.1 | 11.8 | 72.7 | 11.2 |
| | 50 | - | - | - | - | 26.9 | 24.2 | 34.8 | 20.2 | 41.3 | 17.8 | 47.2 | 16.0 | 52.7 | 14.7 | 58.0 | 13.7 | 63.1 | 12.8 |
| | 60 | - | - | - | - | - | - | - | - | 25.9 | 28.8 | 32.9 | 24.0 | 38.6 | 21.1 | 43.7 | 19.0 | 48.4 | 17.4 |
| 10 | 40 | 30.6 | 21.7 | 40.7 | 18.9 | 49.4 | 17.3 | 57.4 | 16.3 | 65.0 | 15.5 | 72.4 | 14.8 | 79.6 | 14.3 | 86.7 | 13.9 | 93.7 | 13.6 |
| | 45 | - | - | 29.3 | 24.0 | 38.5 | 20.8 | 46.2 | 18.9 | 53.3 | 17.6 | 60.0 | 16.7 | 66.5 | 15.9 | 72.8 | 15.3 | 79.0 | 14.8 |
| | 50 | - | - | - | - | 28.3 | 26.2 | 36.7 | 22.7 | 43.8 | 20.5 | 50.2 | 19.0 | 56.2 | 17.9 | 62.0 | 17.0 | 67.6 | 16.3 |
| | 60 | - | - | - | - | - | - | - | - | 26.9 | 30.8 | 34.3 | 26.4 | 40.4 | 23.8 | 45.8 | 21.9 | 50.9 | 20.4 |
| 15 | 40 | 33.1 | 24.0 | 44.5 | 21.7 | 54.4 | 20.4 | 63.6 | 19.6 | 72.5 | 19.0 | 81.1 | 18.5 | 89.6 | 18.1 | 97.9 | 17.8 | 106.2 | 17.5 |
| | 45 | - | - | 31.2 | 26.2 | 41.4 | 23.5 | 50.0 | 21.9 | 57.9 | 20.8 | 65.5 | 20.1 | 72.9 | 19.5 | 80.1 | 19.0 | 87.2 | 18.6 |
| | 50 | - | - | - | - | 29.9 | 28.4 | 39.1 | 25.3 | 46.8 | 23.4 | 53.8 | 22.2 | 60.5 | 21.2 | 67.0 | 20.5 | 73.3 | 19.9 |
| | 60 | - | - | - | - | - | - | - | - | 28.1 | 32.9 | 35.9 | 28.9 | 42.4 | 26.6 | 48.2 | 24.9 | 53.7 | 23.6 |

SAP-60E/SAP-60RE

| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | | | | | | | | | |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | 45 | | 50 | | 55 | | 60 | | 65 | | 70 | | 75 | | 80 | | 85 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 36.7 | 17.3 | 47.6 | 14.2 | 56.6 | 12.3 | 64.9 | 11.1 | 72.8 | 10.2 | 80.3 | 9.5 | 87.7 | 8.9 | 95.0 | 8.5 | 102.1 | 8.1 |
| | 45 | - | - | 35.6 | 19.4 | 45.5 | 15.8 | 53.8 | 13.7 | 61.3 | 12.2 | 68.3 | 11.2 | 75.1 | 10.3 | 81.7 | 9.7 | 88.1 | 9.2 |
| | 50 | - | - | - | - | 34.7 | 21.4 | 44.0 | 17.4 | 51.6 | 15.1 | 58.4 | 13.4 | 64.8 | 12.2 | 71.0 | 11.3 | 77.0 | 10.5 |
| | 60 | - | - | - | - | - | - | - | - | 33.4 | 25.5 | 41.7 | 20.7 | 48.3 | 17.8 | 54.2 | 15.8 | 59.7 | 14.3 |
| 10 | 40 | 39.0 | 19.8 | 51.0 | 17.1 | 61.1 | 15.6 | 70.4 | 14.6 | 79.2 | 13.8 | 87.8 | 13.3 | 96.3 | 12.8 | 104.6 | 12.5 | 112.8 | 12.2 |
| | 45 | - | - | 37.5 | 21.8 | 48.3 | 18.6 | 57.3 | 16.8 | 65.5 | 15.6 | 73.3 | 14.8 | 80.9 | 14.1 | 88.2 | 13.6 | 95.5 | 13.1 |
| | 50 | - | - | - | - | 36.3 | 23.8 | 46.2 | 20.2 | 54.4 | 18.2 | 61.9 | 16.8 | 68.9 | 15.7 | 75.6 | 14.9 | 82.2 | 14.3 |
| | 60 | - | - | - | - | - | - | - | - | 34.6 | 27.8 | 43.3 | 23.4 | 50.4 | 20.8 | 56.7 | 19.1 | 62.6 | 17.7 |
| 15 | 40 | 42.0 | 22.4 | 55.4 | 20.2 | 66.9 | 19.0 | 77.7 | 18.2 | 88.0 | 17.7 | 98.0 | 17.3 | 107.9 | 17.0 | 117.7 | 16.7 | 127.4 | 16.5 |
| | 45 | - | - | 39.8 | 24.3 | 51.6 | 21.7 | 61.7 | 20.2 | 70.9 | 19.2 | 79.8 | 18.5 | 88.3 | 18.0 | 96.7 | 17.6 | 105.0 | 17.3 |
| | 50 | - | - | - | - | 38.1 | 26.3 | 48.9 | 23.2 | 57.9 | 21.4 | 66.1 | 20.2 | 73.9 | 19.4 | 81.4 | 18.8 | 88.7 | 18.2 |
| | 60 | - | - | - | - | - | - | - | - | 36.0 | 30.2 | 45.2 | 26.3 | 52.7 | 24.0 | 59.5 | 22.4 | 65.9 | 21.3 |

SAP-80E/SAP-80RE

| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | | | | | | | | | |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | 45 | | 50 | | 55 | | 60 | | 65 | | 70 | | 75 | | 80 | | 85 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 52.2 | 19.5 | 68.9 | 16.3 | 83.0 | 14.5 | 95.9 | 13.2 | 108.1 | 12.2 | 119.9 | 11.4 | 131.5 | 10.8 | 142.8 | 10.2 | 153.9 | 9.8 |
| | 45 | - | - | 50.4 | 21.8 | 65.8 | 18.3 | 78.6 | 16.1 | 90.3 | 14.6 | 101.3 | 13.4 | 111.9 | 12.5 | 122.2 | 11.8 | 132.3 | 11.2 |
| | 50 | - | - | - | - | 49.1 | 24.2 | 63.4 | 20.2 | 75.3 | 17.7 | 85.9 | 16.0 | 96.0 | 14.7 | 105.6 | 13.7 | 114.9 | 12.9 |
| | 60 | - | - | - | - | - | - | - | - | 47.2 | 28.8 | 59.9 | 24.0 | 70.3 | 21.1 | 79.5 | 19.0 | 88.2 | 17.4 |
| 10 | 40 | 55.7 | 21.7 | 74.2 | 18.9 | 89.9 | 17.3 | 104.4 | 16.3 | 118.3 | 15.5 | 131.7 | 14.9 | 144.9 | 14.4 | 157.8 | 13.9 | 170.6 | 13.6 |
| | 45 | - | - | 53.4 | 23.9 | 70.1 | 20.8 | 84.1 | 18.9 | 97.0 | 17.6 | 109.2 | 16.7 | 121.0 | 15.9 | 132.5 | 15.3 | 143.8 | 14.8 |
| | 50 | - | - | - | - | 51.6 | 26.2 | 66.9 | 22.6 | 79.7 | 20.5 | 91.3 | 19.0 | 102.3 | 17.9 | 112.9 | 17.0 | 123.1 | 16.3 |
| | 60 | - | - | - | - | - | - | - | - | 49.1 | 30.8 | 62.5 | 26.4 | 73.5 | 23.8 | 83.4 | 21.9 | 92.6 | 20.5 |
| 15 | 40 | 60.3 | 24.0 | 81.1 | 21.7 | 99.1 | 20.4 | 115.8 | 19.6 | 131.9 | 19.0 | 147.6 | 18.5 | 163.0 | 18.1 | 178.3 | 17.8 | 193.4 | 17.6 |
| | 45 | - | - | 56.9 | 26.2 | 75.3 | 23.5 | 91.0 | 21.9 | 105.5 | 20.9 | 119.3 | 20.1 | 132.7 | 19.5 | 145.8 | 19.0 | 158.7 | 18.6 |
| | 50 | - | - | - | - | 54.4 | 28.4 | 71.1 | 25.3 | 85.2 | 23.4 | 98.0 | 22.2 | 110.1 | 21.2 | 121.9 | 20.5 | 133.3 | 19.9 |
| | 60 | - | - | - | - | - | - | - | - | 51.1 | 32.9 | 65.4 | 28.9 | 77.2 | 26.6 | 87.8 | 24.9 | 97.8 | 23.7 |

SAP-100E/SAP-100RE

| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | | | | | | | | | |
|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| | | 45 | | 50 | | 55 | | 60 | | 65 | | 70 | | 75 | | 80 | | 85 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 65.4 | 21.1 | 87.6 | 18.0 | 106.4 | 16.1 | 123.7 | 14.8 | 140.1 | 13.8 | 156.0 | 13.0 | 171.4 | 12.4 | 186.7 | 11.8 | 201.7 | 11.3 |
| | 45 | - | - | 63.2 | 23.6 | 83.6 | 20.1 | 100.7 | 18.0 | 116.3 | 16.4 | 131.1 | 15.3 | 145.3 | 14.4 | 159.1 | 13.6 | 172.7 | 12.9 |
| | 50 | - | - | - | - | 61.4 | 26.1 | 80.4 | 22.2 | 96.2 | 19.8 | 110.5 | 18.1 | 124.0 | 16.8 | 136.9 | 15.7 | 149.4 | 14.9 |
| | 60 | - | - | - | - | - | - | - | - | 59.0 | 31.2 | 75.9 | 26.5 | 89.7 | 23.6 | 102.1 | 21.5 | 113.6 | 19.8 |
| 10 | 40 | 70.2 | 23.0 | 94.7 | 20.4 | 115.7 | 18.8 | 135.2 | 17.7 | 153.8 | 16.9 | 171.8 | 16.2 | 189.5 | 15.7 | 206.8 | 15.3 | 224.1 | 14.9 |
| | 45 | - | - | 67.0 | 25.5 | 89.3 | 22.4 | 108.0 | 20.5 | 125.3 | 19.2 | 141.7 | 18.3 | 157.5 | 17.5 | 173.0 | 16.9 | 188.1 | 16.3 |
| | 50 | - | - | - | -</ | | | | | | | | | | | | | | |

| SAP-30ME/SAP-30MRE | | | | | | | | | | | |
|--------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | |
| | | 45 | | 50 | | 55 | | 60 | | 65 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 20.7 | 20.9 | 27.7 | 17.8 | 33.6 | 15.9 | 39.1 | 14.5 | 44.3 | 13.5 |
| | 45 | - | - | 20.0 | 23.5 | 26.4 | 19.9 | 31.8 | 17.7 | 36.8 | 16.2 |
| | 50 | - | - | - | - | 19.4 | 26.0 | 25.5 | 22.0 | 30.4 | 19.5 |
| | 60 | - | - | - | - | - | - | - | - | 18.7 | 30.9 |
| 10 | 40 | 22.2 | 22.9 | 30.0 | 20.2 | 36.6 | 18.5 | 42.7 | 17.4 | 48.6 | 16.6 |
| | 45 | - | - | 21.2 | 25.4 | 28.2 | 22.2 | 34.2 | 20.3 | 39.6 | 19.0 |
| | 50 | - | - | - | - | 20.5 | 27.8 | 26.9 | 24.2 | 32.3 | 22.1 |
| | 60 | - | - | - | - | - | - | - | - | 19.4 | 32.8 |
| 15 | 40 | 24.1 | 25.0 | 32.9 | 22.7 | 40.5 | 21.4 | 47.6 | 20.5 | 54.4 | 19.9 |
| | 45 | - | - | 22.7 | 27.4 | 30.5 | 24.7 | 37.1 | 23.1 | 43.2 | 22.0 |
| | 50 | - | - | - | - | 21.7 | 29.8 | 28.7 | 26.6 | 34.6 | 24.8 |
| | 60 | - | - | - | - | - | - | - | - | 20.3 | 34.7 |

| SAP-40ME/SAP-40MRE | | | | | | | | | | | |
|--------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | |
| | | 45 | | 50 | | 55 | | 60 | | 65 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 26.2 | 19.0 | 34.4 | 15.8 | 41.3 | 13.9 | 47.7 | 12.6 | 53.7 | 11.6 |
| | 45 | - | - | 25.3 | 21.2 | 32.9 | 17.6 | 39.2 | 15.4 | 44.9 | 13.9 |
| | 50 | - | - | - | - | 24.7 | 23.5 | 31.7 | 19.4 | 37.5 | 17.0 |
| | 60 | - | - | - | - | - | - | - | - | 23.7 | 28.0 |
| 10 | 40 | 27.9 | 21.2 | 37.0 | 18.4 | 44.7 | 16.8 | 51.9 | 15.8 | 58.7 | 15.0 |
| | 45 | - | - | 26.8 | 23.4 | 35.0 | 20.2 | 41.9 | 18.3 | 48.2 | 17.1 |
| | 50 | - | - | - | - | 25.9 | 25.6 | 33.4 | 22.0 | 39.7 | 19.9 |
| | 60 | - | - | - | - | - | - | - | - | 24.6 | 30.0 |
| 15 | 40 | 30.2 | 23.6 | 40.4 | 21.3 | 49.2 | 20.0 | 57.5 | 19.2 | 65.3 | 18.6 |
| | 45 | - | - | 28.5 | 25.7 | 37.6 | 23.0 | 45.3 | 21.4 | 52.4 | 20.4 |
| | 50 | - | - | - | - | 27.3 | 27.9 | 35.5 | 24.7 | 42.4 | 22.9 |
| | 60 | - | - | - | - | - | - | - | - | 25.7 | 32.2 |

| SAP-50ME/SAP-50MRE | | | | | | | | | | | |
|--------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | |
| | | 45 | | 50 | | 55 | | 60 | | 65 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 33.2 | 16.7 | 42.7 | 13.6 | 50.7 | 11.8 | 58.0 | 10.6 | 64.9 | 9.7 |
| | 45 | - | - | 32.1 | 18.7 | 40.9 | 15.2 | 48.2 | 13.1 | 54.8 | 11.7 |
| | 50 | - | - | - | - | 31.3 | 20.7 | 39.5 | 16.7 | 46.2 | 14.4 |
| | 60 | - | - | - | - | - | - | - | - | 30.2 | 24.6 |
| 10 | 40 | 35.2 | 19.3 | 45.7 | 16.6 | 54.6 | 15.1 | 62.8 | 14.1 | 70.6 | 13.4 |
| | 45 | - | - | 33.8 | 21.2 | 43.3 | 18.1 | 51.3 | 16.3 | 58.5 | 15.1 |
| | 50 | - | - | - | - | 32.8 | 23.1 | 41.5 | 19.6 | 48.7 | 17.6 |
| | 60 | - | - | - | - | - | - | - | - | 31.3 | 27.0 |
| 15 | 40 | 37.8 | 22.0 | 49.6 | 19.8 | 59.8 | 18.7 | 69.2 | 17.9 | 78.3 | 17.4 |
| | 45 | - | - | 35.8 | 23.8 | 46.3 | 21.2 | 55.1 | 19.8 | 63.3 | 18.8 |
| | 50 | - | - | - | - | 34.4 | 25.7 | 43.9 | 22.6 | 51.8 | 20.9 |
| | 60 | - | - | - | - | - | - | - | - | 32.5 | 29.5 |

| SAP-70ME/SAP-70MRE | | | | | | | | | | | |
|--------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | |
| | | 45 | | 50 | | 55 | | 60 | | 65 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 45.8 | 18.7 | 60.0 | 15.5 | 71.9 | 13.6 | 82.8 | 12.3 | 93.2 | 11.4 |
| | 45 | - | - | 44.3 | 20.9 | 57.4 | 17.3 | 68.2 | 15.1 | 78.1 | 13.6 |
| | 50 | - | - | - | - | 43.1 | 23.1 | 55.3 | 19.1 | 65.3 | 16.7 |
| | 60 | - | - | - | - | - | - | - | - | 41.5 | 27.5 |
| 10 | 40 | 48.8 | 20.9 | 64.5 | 18.2 | 77.8 | 16.6 | 90.1 | 15.6 | 101.8 | 14.8 |
| | 45 | - | - | 46.8 | 23.1 | 61.0 | 19.9 | 72.8 | 18.1 | 83.7 | 16.8 |
| | 50 | - | - | - | - | 45.2 | 25.3 | 58.3 | 21.7 | 69.1 | 19.6 |
| | 60 | - | - | - | - | - | - | - | - | 43.1 | 29.6 |
| 15 | 40 | 52.7 | 23.4 | 70.3 | 21.1 | 85.5 | 19.9 | 99.7 | 19.0 | 113.3 | 18.4 |
| | 45 | - | - | 49.8 | 25.5 | 65.4 | 22.8 | 78.7 | 21.2 | 90.9 | 20.2 |
| | 50 | - | - | - | - | 47.7 | 27.6 | 61.8 | 24.4 | 73.7 | 22.6 |
| | 60 | - | - | - | - | - | - | - | - | 44.8 | 31.9 |

| SAP-90ME/SAP-90MRE | | | | | | | | | | | |
|--------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| T2in [°C] | T2out [°C] | T1in [°C] | | | | | | | | | |
| | | 45 | | 50 | | 55 | | 60 | | 65 | |
| | | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] | G2 [l/min] | T1out [°C] |
| 5 | 40 | 56.9 | 20.1 | 75.5 | 16.9 | 91.2 | 15.1 | 105.7 | 13.7 | 119.3 | 12.8 |
| | 45 | - | - | 55.0 | 22.5 | 72.1 | 18.9 | 86.4 | 16.8 | 99.4 | 15.3 |
| | 50 | - | - | - | - | 53.5 | 24.9 | 69.5 | 20.9 | 82.7 | 18.5 |
| | 60 | - | - | - | - | - | - | - | - | 51.4 | 29.7 |
| 10 | 40 | 60.9 | 22.2 | 81.4 | 19.5 | 99.0 | 17.9 | 115.2 | 16.8 | 130.7 | 16.0 |
| | 45 | - | - | 58.2 | 24.5 | 76.9 | 21.4 | 92.6 | 19.5 | 106.9 | 18.2 |
| | 50 | - | - | - | - | 56.2 | 26.9 | 73.4 | 23.3 | 87.7 | 21.2 |
| | 60 | - | - | - | - | - | - | - | - | 53.5 | 31.6 |
| 15 | 40 | 65.9 | 24.4 | 89.1 | 22.1 | 109.2 | 20.9 | 128.0 | 20.0 | 146.0 | 19.4 |
| | 45 | - | - | 62.2 | 26.7 | 82.7 | 24.0 | 100.2 | 22.4 | 116.4 | 21.3 |
| | 50 | - | - | - | - | 59.4 | 29.0 | 78.1 | 25.9 | 93.7 | 24.0 |
| | 60 | - | - | - | - | - | - | - | - | 55.8 | 33.6 |

Fig. 8

