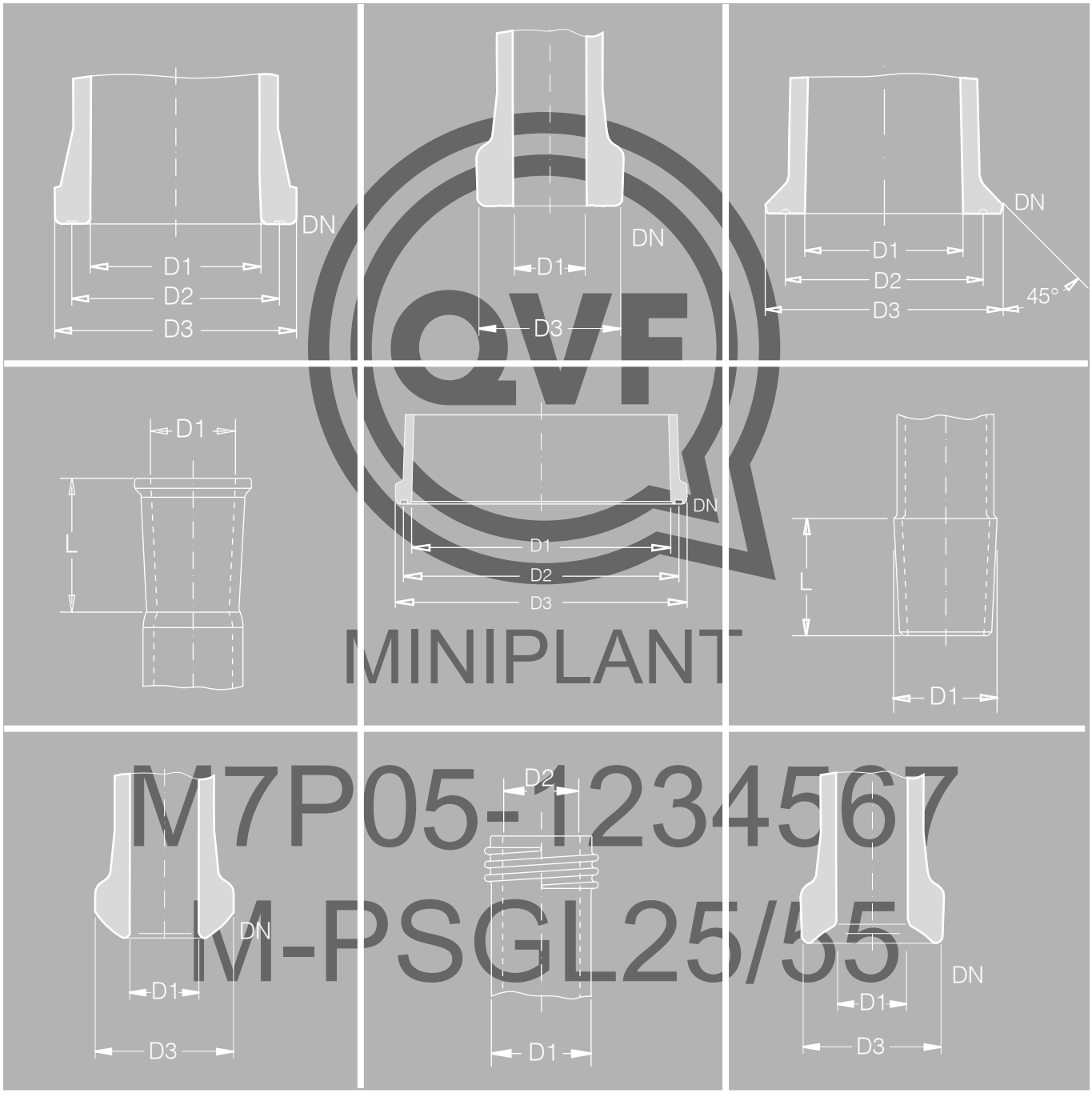
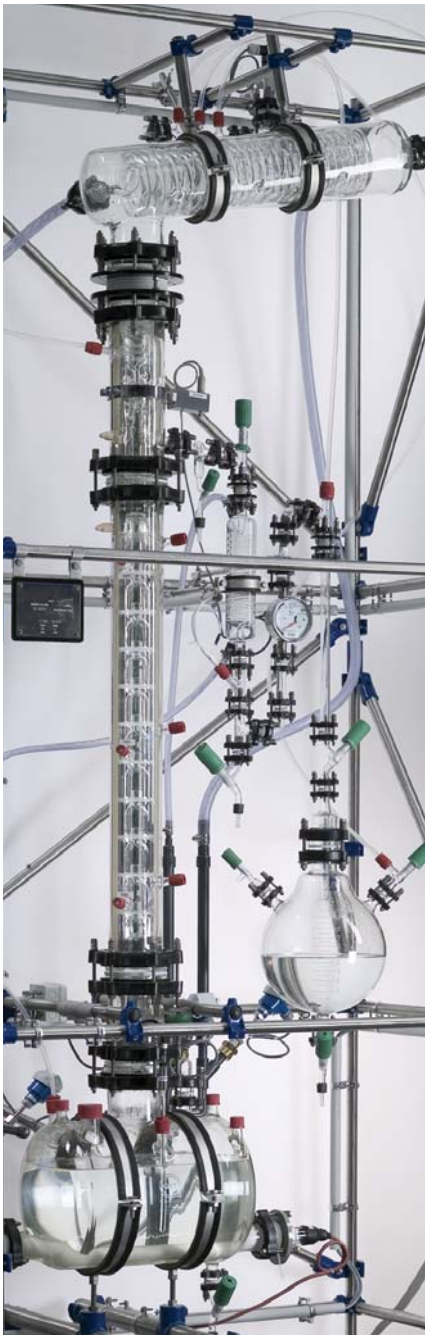


Significance of the Miniplant Technology



Miniplant technology is regularly used today in developing process production facilities. The cost savings this achieves result mainly from bypassing the engineering stage, which, experience shows, requires much time and high costs from the time of initial approval until the plant is operational. In contrast, Miniplant facilities with their low product volumes are normally built up quickly and inexpensively.

The design of the QVF Miniplant components permits simulation of a complete technical process, obtaining of samples, and the development and examination of the process strategy. In particular, the reaction of individual processes to the entire chain can be examined. The study of all processes, taking into account computer-assisted calculations, makes the scale-up of the production units possible under certain conditions. For fluid processes, the available plant components are fully developed and permit scale-up ratios of up to 1:10000. This holds for solid processes as well, with limitations, but here further development is needed.

The Miniplant technology is performed with small quantities on the kilo scale. As a rule, one can assume volumes of 5 to 10 liters for discontinuous processes, and column diameters of around 50 mm for continuous processes. The small quantities and diameter require special measures regarding process data recording, feeding and heat balances.

Only the interplay of the components with the measurement and control technology and the conscientious engineering of the plant ensure the success of the Miniplant technology.

QVF Miniplant System

The Miniplant components developed by QVF supplement the component system for technical glass apparatus construction. But whereas the components of the **World Product Range 2002** are assigned the CE mark as pressure-bearing components in accordance with the Pressure Equipment Directive PED 97/23 EC, Miniplant facilities are operated with a maximum excess operating pressure of 0.5 bar and are therefore not assigned the CE mark (see "Operating Conditions"). Of course, the layout and calculation, production and testing of the Miniplant components fall under the AD-200 regulations, and these components are produced with the same process monitoring in QVF's QA management system.

The Miniplant components are given the QVF product label and the term "Miniplant" for differentiation. All order designations of the Miniplant components program start with M-... and thus show that they belong to these components.

Marking of Glass Components

All glass components from the Miniplant program are marked with the specifications of the corresponding component. The information they contain can be taken from the following table.

MINIPLANT
BORO 3.3
M7P05-1234567
M-PSGL25/55

Table 1

Part of mark	Meaning	Remarks
QVF-logo	Manufacturer of component	
Boro 3.3	Material borosilicat glass 3.3	
M	Place of manufacture	M=Mainz, Germany
7	Strength parameter to EN 1595	
05	Catalogue issue	05 = 2005
1234567	Batch serial number	Sequential number
M-PSGL25/55	Catalogue item reference	For standard component

Borosilicate glass 3.3

The standardized apparatus material borosilicate glass 3.3 is distinguished by an almost universal corrosion resistance and outstanding surface characteristics. As a result, it is the preferred material for Miniplant facilities and permits visual observation of the process and also good cleaning.

The characteristics of borosilicate glass 3.3, which QVF uses exclusively, are described in the WPR 2002 catalogue. Layout and calculation of the Miniplant components are performed according to AD instruction sheets and the current standards.

Permissible Operating Conditions

The permissible operating conditions result from the calculation of the permissible tensions in accordance with EN 1595, taking into account pressure and temperature influences. All glass parts are dimensioned so that the maximum temperature difference between the inside and outside space is 180°C and the permissible excess operating pressure is -1/+0.5 bar. The maximum use temperature for glass components is 200°C.

The same operating conditions apply for jacketed components, double-shell components and components with insulating jacket, but the information on temperature shock must be given special attention. Rapid temperature changes should be avoided with glass components. The temperature gradients must be limited, especially for process-related temperature changes, e.g. changeover from heating to cooling. A temperature shock of 120°C must not be exceeded.

If operating conditions must be reduced through combinations of materials or other requirements, this is noted for the respective components. Components with expanded operating conditions are also possible and are marked as in the WPR 2002 catalogue in accordance with the PED.

Glass ends

Besides the safety flat flange (safety flat buttress end), the Miniplant technology uses many pipe ends, whose measurements are shown in the table below. Connecting elements, gaskets and the universally usable flexible gasket, which allows a deflection in the flat connection of up to 3°, are described in the WPR 2002 catalogue.

Connecting elements for pipelines with threaded pipe ends are described in the "Connections" section. For pipeline components with threaded ends, pipe lengths with the threaded connectors normally result in a 25 mm matrix, which permits interchangeability of the components against other shapes.

Safety flat buttress ends

This flange taken from the technical construction set offers a fire-polished gasket surface with a groove for the gasket. Besides the very high corrosion resistance, this connection system offers special advantages for construction in accordance with GMP standards. Connecting elements, such as flanges, gaskets and inserts, that correspond to the respective structural shape are available.

A

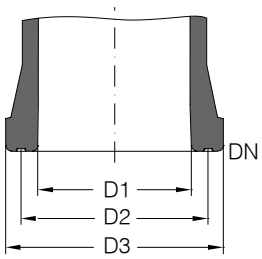
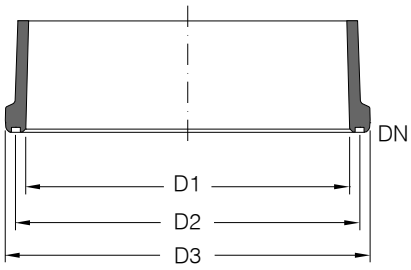


Table 2

DN	D1	D2	D3	Type
15	16,8	23	28,6	**A**
25	26,5	34	42,2	**A**
40	38,5	48	57,4	**A**
50	50,5	60,5	70	**A**
80	76	88	99,2	**A**
100	104,5	120,5	132,6	**A**
150	154	172	185	**A**
200	203	220	235	**B**
300	300	321	340	**B**

B



Laboratory flanged pipe ends

Laboratory flanged pipe ends are used for the reactor flange and hood, especially for small reaction vessels. Here, the O-ring seal lies in a polished groove. The laboratory flanged pipe ends are marked with "SLF" in the tables.

C

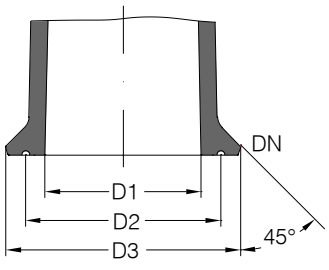


Table 3

SLF	D1	D2	D3	Type
100	100	115	138	**C**
150	148	161	184	**C**
200	205	220	242	**C**

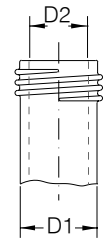
Threaded pipe ends

The standardized glass pipe ends with round threads are frequently used for connecting hoses and measurement transducers. In the tables, connections with threaded pipe ends are shown with the letter code "GL".

Table 4

GL	D1	D2	Type
14	12	8,1	D
18	16	10,5	D
25	22	16,5	D
32	28	21,5	D
45	40	34,5	D

D



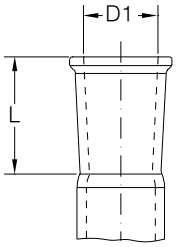
Taper ground connection

The connection with a taper of 1:10, common in laboratory applications, is used to connect laboratory devices to Miniplant facilities. The dimensions correspond to DIN 12 242. Taper ground connections are also called standard ground (Normschliff) connections and identified with NS. Taper ground connections cannot be used with excess pressure.

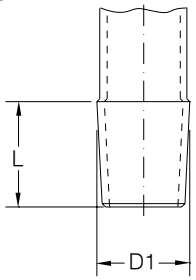
Table 5

NS	D1	L in mm	Type
14/23	14,5	23	E
29/32	29,2	32	E

E Sleeve



Core



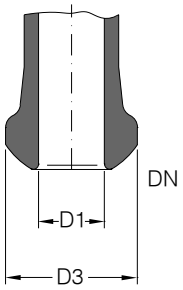
KF couplings

Corresponding to the earlier Schott "6076" connection system, the KF connection (KF = Kugel-Flansch or conical flange) permits an angular deviation of the connection by 3° without additional components. The sealing surfaces are ground. Safety flat flanges and KF pipe ends can be connected with transition gaskets or glass transition pieces.

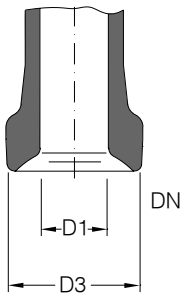
Table 6

DN	D1	D3	Type
15	15	30	F
25	25	25	F
40	40	62	F
50	50	76	F
80	81,5	109,5	F

F Bowl



Socket



Jacketed glass components

Jackets are often used to heat or cool vessels and pipelines. Jackets are normally fused together with the component on both sides so leaks cannot arise. The heat-transfer medium is connected via safety flat flange pipe ends and the appropriate adapter to entry and exit connection pieces.

For jackets fused together on both sides, the allowable operating temperature in the jacket space is 200°C. At the same time, it must not be more than 180°C above the ambient temperature nor exceed the product temperature by more than 50°C. Of course, the information on temperature shock must be observed.

The permitted excess operating pressure in the jacket is -1 to 0.5 bar.

Isolating jackets

Various components for the Miniplant technology (e.g. columns) are also offered with special isolating jackets. In these cases, the inside of the jackets made according to fig. 3 are silver-coated and the jackets space itself evacuated. In this way, undesired heat losses are reduced to a minimum.

Both of these measures are combined in the case of the triple-wall reactor "TWR..."; but to permit a better observation of the process, the isolating jacket is not silver-coated. It prevents heat loss and ice formation on the outside for processes below the freezing point.