Part 7

ENERGY SAVING

7.3. New sealing and fire-proof materials for power enterprises

7.3.7. Hermetic sealing of flange joints

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Along with the seals of gland joints of pumps, the gaskets of "Graphlex" mark find wider application for hermetic sealing of pumps.

The gaskets "Graphlex" can be used at their contact with oil and petroleum products in the total range of their parameters during the processing with water up to temperature of 384°C and steam up to 560°C. Use of gasket materials made of TEG for the most difficult conditions of flange joints operation will provide the achievement of reliable hermetic sealing during the total overhaul period of equipment operation due to the material elasticity and its conservation of initial properties at multiple changes of thermal and mechanical loads.

The gaskets "Graphlex" are intended for sealing of apparatus (vessel) flanges, pipelines and accessories with diameter from 10 to 3000 mm, operating under pressure up to 100 MPa in the range of temperatures from –200°C to +450°C at contacting with air and up to 1500°C — for inertial medium or deep vacuum. The operating temperature for oxidizing media is determined by the resistance of steel parts of gaskets, excluding the direct contact of medium with material "Graphlex". Conditions of application of the gaskets of different types are presented in table 7.6.

Results of experimental investigations carried out by the CJSC "Unikhimtek" together with the OJSC «Irkutskkhimmach» as well as results of pilot operational showed that for the connectors working under the conditions of constant changes of load and temperature, GGF gaskets provide better hermetic sealing under high pressure. GGF gaskets are made of pure graphite and have different performance, depending on the flange type and operating conditions. Due to the elastic properties of graphite, these gaskets can provide the hermetic sealing even with the partial opening of flange connector. The permissible opening is determined by the construction and density of gasket material and is set at the stage of gasket design. Such gaskets are individually estimated for each joint.

As the investigations showed, the hermetic sealing is secured with the gasket coefficient m = 1.2 under the high specific load per a gasket q > 50 MPa. The largest effect is achieved with using such gaskets in the flange connectors of types "lock" и "notch-surface". GGF gaskets for flange connectors of other types are made with the compression limiters, which prevent them from overloads at load variations. One from the options of gasket execution with inside compression limiter is presented in fig. 7.25.

Hermetic sealing of detachable joint is achieved only by means of elasticity of GGF gasket, pressed with the specific load in correspondence with gasket coefficient. The other force from the fastener tightening is taken by means of contact of flange metal or limiter metal with flange.

GGF gaskets are currently used for hermetic sealing of the basic connectors of main circulating pumps (MCP), produced by Central Design Bureau of Machine Building (CDBM) in Saint-Petersburg city. The complete sets of gaskets of such type have been successfully used for more than six years at the feed pumps "Zultser" with the parameters of feed water p = 35 MPa and t = 175 °C. The complete sets of these gaskets are installed at 21 pumps in the OJSC "Rosenberg".

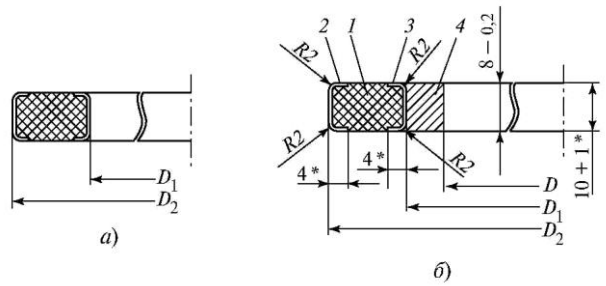

Fig. 7.25. Construction of GGF gaskets:
a — GGF gasket with seals of type 03; *b* — GGF gasket with seals of 03 type and end ring (inside); *1* — graphite packing; *2* — outside seal; *3* — inner seal; *4* — end ring
* — sizes «for references»

The gaskets of GRGF type are widely used for hermetic sealing of detachable joints, working under high pressures. These gaskets have the tooth steel base, which is coated by graphite foil. Construction of such gasket is presented in fig. 7.26.

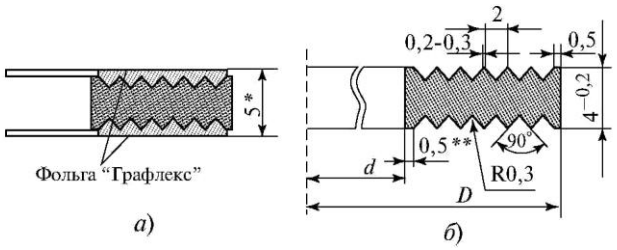

Fig 7.26. Construction of tooth gaskets GRGF coated by graphite foil «Graphlex»:
a — ready-fitted gasket GRGF; *b* — steel tooth base; фольга «Графлекс» - "Graphlex" foil
* — size "for references"; ** — minimal residual dimension for teeth formation

GRGF gaskets provide the hermetic sealing of detachable joint by means of elasticity of coating graphite layers allowing to take the load (specific load 30—100 MPa) due to the choice of necessary mass (density) of graphite. By that only light contact of tooth tips with flange metal is secured. The tooth tips, being the limiter of axial compression, create the closed volume for graphite and exclude its washout by working medium or the burn-out under influence of aggressive gases or high temperatures. All the mentioned above allows to use the gaskets GRGF 'Graphlex' under high medium parameters p = 100 MPa and t = 600°C.

Table 7.6. **Main characteristic and conditions of application for gaskets of different type**

Item	Catalogue designation	Packing coefficient m			Pressure of compression under working conditions	
		Working medium				
		Liquids	Air, steam, steam-water mixture	Gases with high penetrability (hydrogen, helium etc.)	minimal q_{min}	allowable q_{max}
1	Flange and not reinforced gasket GGF with shutter and compression limiter (CL) by standard 5728-016-13267785-99	1.6	2.0	3.0	5.0	200
2	Flange and not reinforced gasket GGF with shutter and without compression limiter (CL) by standard 5728-016-13267785-99	1.6	2.2	3.2	5.0	До 400
3	Flange and reinforced gasket GRGF without shutter by standard 5728-011-13267785-99	2.0	2.5	3.0	5.0	60 for t = 2 mm* 50 for t = 3 mm*
4	Flange and reinforced gasket GRGF with shutter by standard 5728-011-13267785-99	2.0	2.3	3.0	5.0	100
5	Flange gasket GRGF on steel tooth base by standard 5728-012-13267785-99	2.0	3.0	4.0	8.0	До 400
6	Flange and rolled over gasket GRGF by standard 5728-014-13267785-99	3.5	6	8	160	350
7	Gaskets SNG by standard 5728-033-50187417-04	1.6	2.0	3.0	5.0	100

*t — thickness of gasket