Enterprises of the chemical and petrochemical industries are operating equipment that for the most part is obsolete. In view of this, enterprises asked the firm NPF TsKBA to design new fittings, including some for use in corrosive media.

Over a number of years, NPF TsKBA has been drawing up design documentation for ball valves to be used with natural gas with an elevated hydrogen sulfide content.

Ball valves with nominal bores $DN$ of 40, 50, 80, 100, 150, and 200 and nominal pressures $PN$ of 10, 25, 40, and 80 have been developed. Floating-ball valves (Fig. 1a) have been designed for low pressures (up to $PN$ 40, inclusively) and small nominal bores while trunnion-mounted ball valves (Fig. 1b) have been designed for high pressures ($PN$ 80) and large nominal bores to reduce the control torque.

The special requirements for these fittings are that they be more resistant to the corrosive action of the working medium and that they have no leaks into the surroundings. The packing gland is the weakest point in the fittings for such conditions. Accordingly, the packing gland has been redesigned for the valve. In floating-ball valves, it is made as double unit (end and radial) and the stem is put inside the body, which prevents its being extracted from the body by the pressure of the medium. Trunnion-mounted ball valves have rubber rings. For better maintenance, it is made with a packing bush that allows the rubber rings to be replaced quickly. Ftoroplast (Polytetrafluoroethylene) (for $PN$ 10, 25), Flubon (a fluorocarbon resin) (for $PN$ 80) is used in the seal. Ball valves with $DN$ 200 (for $PN$ 10, 40), fitted with a pneumatic drive (the others are made with manual control), are intended for installation on pipelines that transport media containing mechanical admixtures. Polyurethane, therefore, is used as the sealing material in the valve. A drainage hole is provided for flushing the stagnation chamber.

The main components of these valves are made of corrosion-resistant austenitic steels that were specially heat-treated and ensure resistance to hydrogen sulfide cracking (HSC).

The chemical composition and the mechanical characteristics of each batch of metal used for those parts are checked and the steels of the individual grades are also tested for HSC resistance. Particular attention is focused on the design and choice of the fasteners to ensure that the gasketed connection is leaktight, since its failure due to the prolonged action of hydrogen sulfide vapor may cause the body to leak and pollute the environment.

The valves have the designated durability, which ensures that they function reliably during the lifetime cycle with allowance for the next critical failure, due to leakage to the ambient environment. The specified valve work time is 10 yr (with replacement of the RTD) and the specified service life is 3000 cycles (80000 h).

A batch of test products was put into trial operation.

NPF TsKBA has also developed ball valves for work with chlorine ($DN$ 6–200, $PN$ 16) and ammonia ($DN$ 40, 50, $PN$ 80). The requirements for these ball valves are similar in many ways to those for the designs of valves to work with hydrogen sulfide. The designs of the main subassemblies, therefore, are similar.

The fixed releasible connections are made leaktight by Ftoroplast gaskets installed in enclosed spaces.
The choice of materials is an important factor that ensures reliable valve operation when working with chlorine. The materials should be resistant to moist chlorine, whereby all the crucial components of the valve are made of corrosion-resistant steel. In accordance with the recommendations of Khlorbezopasnot' RTs, the valve for liquid chlorine \( t = -70^\circ C \) has a hole in the ball to prevent a pressure increase in the space between the seats in the body (in the “enclosed” portion) when liquid chlorine vaporizes.

The principal difference in the ammonia valve is that the neck of the body with packing gland is elongated to make room for insulation and the body parts are made of carbon steel.

Valves developed for work with chlorine have been used successfully in waterworks (St. Petersburg and Ivanovo) and valves for ammonia, in the food industry.

Safety gear recently developed at NPF TsKBA:

- Safety valve for nitrogen trifluoride at \(-190\) to \(+20^\circ C\), \( DN 15 \) with an adjustment pressure of 16–23 MPa (Fig. 2). The design is made as a direct-acting spring-loaded valve with manual setting. Bellows are used to seal the stem and metal-to-metal sealing in used in the gate. The valve is made of materials that are corrosion-resistant in the given medium and ensure the necessary mechanical properties at the given temperature. This valve is being used as a component of a technological installations.

- Safety valves for ammonia \( DN 15, 25, 50 \) with \( PN 25/10 \) (inlet/outlet). The adjustment pressure of the \( DN 15 \) valve is 1.2 MPa while the pressures in the other valves are equal to the nominal adjustment range \( \pm 5\% \). These valves has been design as spring direct-action valves, but without manual lifting and metal-to-metal sealing in the gate. The operating temperature of the medium ranges from \(+20\) to \(+180^\circ C\). The valves have been made and tested and have been in use at food industry enterprises.

- Safety valve (Fig. 3) for use in a working medium of increased corrosivity at \(500^\circ C\). This valve was designed after a series-produced spring safety valve set up in a technological installation sprung a seal leak when the spring lost its characteristic because of the high temperature. Since a spring cannot be used for the load under the operating conditions (high temperature, corrosive medium, excluding the use of bellows), the valve is direct-acting (the load is placed right in the valve body). A composite load is used for adjustment of the valve; the pressure is adjusted gradually with this arrangement. The body is made of corrosion-resistant steel and a metal-to-metal seal (nickel alloy) is used. A burstable nickel membrane was