QUALITY, RELIABILITY, AND LIFETIME

EFFORTS TO IMPROVE CENTRIFUGE QUALITY AT
THE M. V. FRUNZE MACHINERY FACTORY IN SUMY

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The M. V. Frunze machinery factory in Sumy is engaged in the production of quantity lots of centrifuges of seven types covering over 40 models and sizes in 90 design variants. The volume of centrifuges manufactured in this factory is increasing year by year. Close attention is being given to improvements in fabrication quality, to raising the overall technical level and the basic performance parameters, and also to expanding the range of different types and variants.

Work on improving the quality and reliability of the centrifuges is proceeding in several basic directions: designing and gaining acceptance for new up-to-date machines while at the same time taking obsolete machines out of production; improving machinery being manufactured in quantity lots; introducing new advanced engineering materials into the production process.

The factory is working jointly with the special chemical process equipment design bureau in investigations of the performance of centrifuges under service conditions on stream, paying special attention in these studies to technological performance factors, durability, and reliability of individual components and parts, as well as of the machine as a whole. That has helped in pinpointing the weak points in the centrifuges, and also in accumulating operating experience. All notes taken on centrifuge performance have been entered in specially prepared questionnaires, for generalized joint discussion with NIIkhimmash and UkrNIIkhimmash design institutes.

These investigations have resulted in new measures being taken to expedite further improvements in centrifuging machinery. A long-term plan covering the years 1971-1975 was drafted in collaboration with NIIkhimmash and UkrNIIkhimmash Institutes, for the development, organization of production, and acceptance on stream of new machines, modernization and redesign of older models, and removal of obsolete process equipment from production. This plan calls for the acceptance of 50 or so new machines and variants in production by the end of the current five-year plan.

The basic trend in the design of centrifuges is the development of heavy-load continuous machinery with pulsed cake discharge, and automatic machines with knife cake discharge, for high-tonnage production in the chemical process industry, and these include both simple and double centrifuges with 2000 mm and 2200 mm bowls (see Fig. 1). This long-term plan calls for the development of machines of these types using new materials to achieve leaktightness (titanium, high-corrosion steels, etc.) and improved engineering performance characteristics.

In recent years, screw-conveyor cake discharge type sedimentation centrifuges have been classified as sedimentation type with L/D ratio below 2 (where L and D are respectively the length and the greatest diameter of the bowl) and clarifier type with L/D ratio greater than 2. This reflects the effort to provide users with machines most closely matching production conditions. The factory used to concentrate on the manufacture of sedimentation type centrifuges. But with the new long-term plan in effect, work is proceeding satisfactorily on the design of centrifuges with L/D ratios of 2.86 and up, and separation factor topping 3000. These centrifuges are already being manufactured in open and in leaktight variants at the factory (see Fig. 2).

The factory has been engaged for quite a while in the manufacture of tubular 100 mm and 150 mm diameter tubular centrifuges in an open variant. These centrifuges are not to be used in the processing of suspensions or slurries presenting explosion or fire hazards. Nor can they be rendered leaktight with
their existing set of parts. At the present time, a leaktight 150 mm diameter tubular centrifuge is being designed in joint work with NIIkhimmash Institute, to be driven directly by a high frequency electric motor.

In the course of the present five-year plan, the factory has mastered production problems in the manufacture of two new types of centrifuges: the FVI-1001 for applications in the sugar industry, and the FGSh-401K-1 centrifuge for processing Glauber's salt in the production of artificial fibers.

A reliability team was set up at the factory to expedite constant improvements in machinery manufactured in quantity lots. The following work has been accomplished by this group following the guidelines of the annual factory plans.

Types OGSh, FGP, and FGN centrifuges have been equipped with vibration insulating devices to virtually minimize dynamic loads generated on stream, and the centrifuges have been installed on special flooring laid between the usual floors. This has eliminated the need to build cumbersome foundations, and has resulted in impressive savings in materials (about 1000 rubles worth per centrifuge installed on stream).

The cumbersome friction breaking couplings in the power drives of horizontal centrifuges have been replaced by hydrodynamic starting and braking couplings distinguished by simplicity of design, absence of rapidly wearing parts, explosion-proofed design, and reliability in service. Operating experience with these couplings has demonstrated that they provide reliable overload protection for the electric drive motor during starting and stopping. Tests run on a special-design two-speed electric drive motor which facilitates speeding up and slowing down the centrifuge without having to resort to hydrodynamic couplings or other speed-adjustment devices have been encouraging.

New contact type level annunciating devices are being used in automatic horizontal centrifuges, and are so designed that the centrifuge can be loaded up to the point that cake piles up to a specified level in the bowl. The controller devices installed bring the centrifuge throughput 10-15% higher.

The service life of the discharge knives is increased by a factor of 5 to 6 in the processing of abrasive products, through the use of hardfacing with V3K hard alloy, as well as ceramic plating.

The problem of unloading products of different moisture content from FGN type centrifuges has been solved through recourse to high-quality centrifugal type vibrators. The use of these vibrators makes it possible to completely automate the process of unloading the dried product, and to improve the working conditions for the operating personnel.

Contactless limit switches introduced into the automatic control system automatically enhance the service reliability of the centrifuges working on highly corrosive streams or with media presenting an explosion hazard.

The screw conveyor design adopted for batch screw conveyor centrifuges favors easy balancing on its own supports, so that excellent dynamic balance of the centrifuge becomes possible. A new design of the unloading chamber has been introduced for the screw conveyor assembly, thereby eliminating clogging of the chamber by products. Changes in satellite support designs and improvements in the manufacturing