Lack of quality control of X-ray diagnostic equipment performance results in radiation overload of patients through suboptimal selection of parameters of X-ray examination or by the necessity of repeated surveys. It also causes waste of photoradiographic materials, decreases the ability of the equipment to serve more patients, and jeopardizes the public image of diagnostic radiological service. Therefore, in Western countries much attention is devoted to quality assurance (guarantee of quality) in roentgenology (diagnostic radiology). Some methodological manuals on this subject have been published recently [12, 13, 16, 17, 23]; they were reviewed by the World Health Organization, and the resulting publication [20] encouraged further work on this problem [6, 10, 11, 14, 15, 19, 21, 22]. Development of standards by the International Electrotechnical Commission is now under way [18].

The traditional activities of the Moscow Scientific-Research Institute for Diagnostics and Surgery include development of physical bases for radiological control and diagnosis [4], creation of the prerequisites for standardization in radiological studies [9], and analysis of basic quality characteristics of diagnostic radiological hardware [2]. Methodological recommendations for quality assurance of individual installations of such equipment were published in [7, 8]. Some other institutions deal with similar subjects but from a slightly different point of view [1].

Analysis of the results of research and practical studies allows formulation of the requirements for a set of test objects for quality testing of radiological diagnostic equipment and physicotechnical conditions for its use. The set developed to meet these requirements allows implementation of previously proposed methods of testing of radiological equipment, detectors, and photographic processes [5]. The set (see Fig. 1) consists of a carrying case (attache case) where five groups (20 items) of test objects and detailed operating instruction are packed. Methods for the application of the test objects in the instruction are grouped in accordance with areas to be monitored and are written in a similar manner: they include description of the purpose of the testing, list of required instruments, description of the procedure itself, evaluation of the results, and also volume, periodicity of testing, and names of technicians performing the inspection. Monitoring schemes are also available if needed.

The first group of test objects (Fig. 2) contains tools for testing the quality of installation of equipment in the X-ray room: a plumb bob, a level, and a measuring tape. The use of these tools is rather obvious. For some purposes, for example, to evaluate velocity or force, a timer and a dynamometer should be added to the set.

The second group of test objects (Fig. 3) comprises instruments designed for X-ray source quality control: a cylinder with crosses, a chamber with a pin hole (both manufactured in accordance with international standards), and a hand-driven spinner. Perpendicular alignment of the central beam to the plane of the deck can be evaluated from photographic pictures of the crosses. Pictures of the chamber allow correction of the X-ray focus position, while pictures of the rotating spinner provide for determination of the X-ray exposure. The currently used spinner is scheduled for replacement by test-cassette TKR-1, the latter allowing evaluation of the anode voltage as well as the X-ray exposure.

The third group of test objects (Fig. 4) contains devices for quality assurance of X-ray image transducers (cassettes, combinations of amplifying screens and films, roentgenoscopic screens, amplifiers of X-ray images, video channels, etc.). An X-ray line focus target (lead raster) with 0.8-5.0 lines/mm (see Fig. 4, center) allows determination of spatial resolving power of an X-ray image formation section. The exact value of the sensitivity of this section, i.e., the resolution of details on the image, can be evaluated using a set of 150 disks ("Teston"-type, 10 mm in diameter and 1.5 mm thick [3]), 75 of them with recess and 75
Diameter and depth of the recesses vary from 0.5 to 1.9 mm in arithmetic progression with 0.1 mm step (five disks of each type). Disks are randomly arranged in a plastic box (see Fig. 4, bottom). The number of clear and unclear images of visible recesses as well as the number of invisible recesses on pictures are independently calculated by several operators; statistical parameters of resolution, threshold size of visible recesses, and corresponding probability of identification being determined from the results. Copper step wedges (see Fig. 4, left and right sides of the bottom) are used for measuring dynamic range limits. Minimal resolved contrast of the image can be measured using a plate with ten aluminum disks of the same diameter (10 mm) but of different thickness (from 0.1 to 1.0 mm with 0.1 mm step). Since the resolved contrast should be reevaluated using radiation passed through an object of the same material, the set is supplemented with an aluminum filter 20