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CENTRAL INTELLIGENCE AGENCY

[redacted]

REPORT [redacted] 50X1-HUM

CD NO. 50X1-HUM

COUNTRY German Democratic Republic

SUBJECT Economic - Electrical industry, production, bulbs

[redacted]

DATE OF INFORMATION 1950

DATE DIST. 17 Jun 1951 50X1-HUM

NO. OF PAGES 9

SUPPLEMENT TO REPORT NO.

THIS IS UNEVALUATED INFORMATION

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BERLIN INCANDESCENT LAMP PLANT

A. Introduction -- General Plant Organization

The buildings formerly housed the management section of the entire Osram enterprise, including the research group, as well as Germany's largest incandescent lamp works, which had a broad manufacturing program and excellent technical and scientific personnel. During the war, the entire installation was badly damaged (about 30% damage by bombings and 20% during the fighting). In 1945, it was almost completely dismantled; only one important unit was overlooked. Troops were quartered in the buildings for some time and reconstruction could not be started until 1946. In the beginning, the plant was run by a trustee appointed by the local government. In 1947, the DTV (German trustee administration for sequestered and confiscated property in the Soviet-occupied sector of Berlin) took over; in 1948, the plant was officially expropriated, and in May 1949, it was included in the Soviet-controlled plants of the RFT (Central Radio and Communications Administration) group to which the other incandescent-lamp-manufacturing plants in the Soviet Zone also belong. At present (July 1950), an area of 23,000 square meters is being used by the plant.

Investments needed for construction (not new construction, but only repairs and equipment) amount to approximately 3,500,000 Deutsche marks at present Soviet Zone prices, but the RFT in Leipzig allowed only 700,000 Deutsche marks for 1950. The plant has no dining room because the actual manufacturing department needs all available room. The kitchen, however, is excellent. A physician is on duty and there is a well-equipped treatment room. A plant-owned shoe-repair shop and a tailor shop are also provided. There is also a kindergarten for the children of working mothers, although not on the grounds of the plant. As in all people-owned establishments, each employee receives, in case of sickness, his sick pay plus 30 percent of his average pay.

B. Personnel

In the past, the plant employed 8,000 people, working in several shifts.

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Personnel in June 1950 (round figures)

	Men	Women	Total	Percent
Administrative employees	125	160	285	23
Technical employees	165	80	245	
Laborers	890	980	1,870	77
Total	1,180	1,220	2,400	100

Distribution of Workers in Individual Departments

Machine-building department		160
Semifinished-materials department		110
Wire department (total)		215
Forging and drawing	80	
Diamond polishing	25	
Spiral winding	70	
Electrodes	40	
Lamp department (total)		675
All-purpose bulbs	225	
Miniature bulbs	210	
Gas-discharge lamps	240	
Hard-metal shop		45

In comparison with other plants, at the end of 1949, the following were employed: Berlin Incandescent Lamp Plant, 2,030 persons; Osram/West Berlin, 5,520 persons; and Osram/West Germany, 2,860 persons.

The large proportion (23 percent) of administrative and technical employees includes approximately 50 people who must be kept on hand for machine building (for plant use only), and 30 men in the guard unit. Also, laboratory personnel are needed to supervise the production of tungsten. They include the following:

Plant Supervisor: Karl Neugebauer

Technical Director: Dr Ing Koehler

Social Director: Groscinski

Chairman of Plant Trade Union Council: Struck

Head of semifinished-materials department: Geyer

Head of wire department: Berg (Assistant, Reichmann)

Head of lamp department: Lietsche

All-purpose bulbs: Lietsche
Miniature bulbs: Hix
Gas-discharge lamps: Dr Neumann
Glow lamps: Vogel

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Head of hard-metal shop: Supervising Engineer Fehse (Assistant, Kreuzfeld)

Head of machine-building department: Saffran

Head of machine-drafting department: Ogrodowy

Head of materials-testing department: Dannenberg

Head of maintenance: Engineer Mueller

Head of TAN (Technical Work Standards) office: Lehmann

Head of planning: Pelzer (Assistant, Preppernau)

Head of cost accounting: Schroeder

Head of personnel office: Hinze

C. Production

During May 1950, a total of 373,000 work hours were recorded, 245,000 (approximately 66 percent) of them entirely for manufacture, the remaining 128,000 hours for machine building and general labor.

1. Tungsten Powder

About 2 tons of tungsten powder was manufactured in the semifinished-materials department.

2. All-Purpose Bulbs

Fifteen-, 25-, 40-, 60-, and 100-watt bulbs (clear glass) were manufactured with automatic machines.

Two hundred- and 300-watt bulbs were made by hand. The quota for 1950 called for 7,920,000 bulbs altogether (approximately 650,000 200-watt bulbs) equally distributed among the 12 months. The quota was slightly overproduced during May (2.4 percent).

On 3 June 1950, the plant turned out the 15 millionth bulb produced since the war.

The automatic machines are operated on two shifts. This puts a great load on the machines and is dangerous, since there are no reserve parts on hand. The management expects an average production of 5,000 lamps per group per shift.

Comparison with other incandescent-lamp plants shows that in December 1949, BGW produced 633,000 bulbs; Osram/West Berlin, 1,927,000; and Osram/West Germany, 2,073,000.

Besides the three groups of automatic machines in operation, five other groups are under construction and are expected to be installed in 1951. At that time, it is expected that one-shift production will be resumed. Under ordinary circumstances, one group produces 5,000-6,000 bulbs per shift. Beginning in 1951, seven of the eight groups will be operating, while one group will be held in reserve or will be undergoing repairs. That would mean, for a one-shift operation, a yearly production of approximately 12 million bulbs. There is no doubt that this number can be reached if the plant can obtain sufficient material.

During the last 3 months, rejects amounted to an average of 12 percent against a prewar average of 5-6 percent. The life span of the bulbs, which had been 1,200 hours, has now been increased to about[redacted] hours.

3. Miniature Bulbs

Low-voltage bulbs are being produced for flashlights, radio dial lights, measuring instruments, etc. Because of the variety of shapes, these bulbs cannot be manufactured on the automatic machines but are produced on the assembly-line principle, although without a conveyer belt. The production of miniature bulbs has not expanded as much as has the production of all-purpose bulbs, because other plants besides BGW, for example, Gluehlampenwerk Oberweissbach VEB, also produce these bulbs. Bilux bulbs, for automobile headlights, are not being manufactured at BGW but at Gluehlampenwerk Plauen, VEB. No increase in the manufacture of miniature bulbs at BGW is anticipated, but the manufacturing methods are to be improved. The quota for 1950 is 5 million bulbs.

Comparison with other incandescent lamp plants, in December 1949, shows that BGW produced 415,000 bulbs; Osram/West Berlin, 1,288,000; and Osram/West Germany, 690,000.

4. Fluorescent Tubes

Only a high-grade 40-watt tube is produced. The quota for 1950 is 400,000; up to the end of May, this quota was filled 98 percent. Although manufacturing methods are rather primitive, 1,000 tubes a day are being produced. An assembly-line system is used. The tubes are coated with the fluorescent material according to a laboratory method, which leads to considerable waste of this expensive material and of manpower as well. The manufacture of the two sockets with spiral filaments is better organized and makes use of a conveyer belt. Evacuation and charging with gas is done at well-arranged tables, [redacted], however, are not fitted for mass production. It is estimated that waste during production averages 15-18 percent.

The starters, which are sold along with the tubes, are not manufactured in this plant.

Comparison with other incandescent lamp plants, in December 1949, shows that BGW produced 33,000 tubes; Osram/West Berlin, 81,500; and Osram/West Germany, 8,500.

The BGW intends to expand considerably the manufacture of fluorescent lamps and to improve manufacturing conditions. There is talk of producing 1.5 million fluorescent tubes in 1951, but the demand for all-purpose lamps is so large that machine building in that field will probably have to take precedence.

The life span of the fluorescent tubes is given as 2,000 hours.

5. High-Voltage Fluorescent Tubes

Each unit is constructed individually. The tubes are produced for illuminated signs; occasionally entire words and sentences are constructed. Production is fairly small; exact figures are not available.

D. Mechanical Equipment

1. Machine-Building Department (Combined With Tool Production)

All special [redacted]ry needed for the manufacture [redacted]candescent bulbs has always been designed and built right in the plant. This also applied to the old Osram plant. This tradition has proved valuable and has helped in the reconstruction of the plant. [redacted] machine shop on Rudolphstrasse was therefore the first unit rebuilt, and, by East Berlin standards, its equipment is excellent.

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All kinds of necessary machines have been installed, including a jig drill, a parallel planing machine, honing machines, and thread-grinding machines. All of these are critical items in the Soviet Zone. Altogether there are 115 machine tools. The personnel of the machine shop is quite remarkable; nearly 30 percent belong to wage group 8 (master machinist).

2. Semifinished Materials Department

Only about 80 percent of this shop was dismantled.

a. Tungsten

Tungsten ore (scheelite) is not smelted on the premises. Instead, tungstic acid, WO_3 (a yellowish-green powder), is used. There are four continuous furnaces with five tubes each, and one experimental furnace with one tube, for reducing the WO_3 to metallic tungsten by the use of hydrogen. So-called Schiffchen (boats) of sheet molybdenum, each with a capacity of about 500 grams, are used to load these furnaces. Reduction takes place at 500-800 degrees C and takes about 10 hours. Progress through the furnace is automatic and at uniform speed. Extensive safety measures are necessary because of the great danger of an explosion of the hydrogen gas.

In hydraulic presses (2,000 kilograms per square centimeter) the crystalline-tungsten powder is shaped into rods 12 x 12 x 400 millimeters. There are two presses, which are busy only about 30 percent of the time on each shift.

Preliminary sintering takes place in electroinduction furnaces at 1,600 degrees C, in the presence of safety gas. The final sintering is done by sending 2,000-3,000-ampere current (12-15 volts) through the material at a temperature of approximately 3,200 degrees C.

b. Glass

There is no glass-melting furnace in the plant; it is therefore necessary to depend on glass rods, tubes, and parts obtained from the outside. Glass testing is an important part of the work, and the testing equipment is very modern. The bulbs, tubes, and rods needed for the manufacture of all-purpose bulbs come to the plant ready for processing. Considerable work is needed to clean the bulbs with hot lye in steam-heated vats.

Miniature bulbs are blown on the premises; five automatic machines produce 15 bulbs per minute. These machines were built from memory, adapted from those previously in the plant. The material needed for the blowing molds at first caused considerable difficulties, since the malleable cast iron previously used had come from the US. After considerable testing, a good substitute was finally found in sintered iron from the Thale Iron and Smelting Works (SAG "Marten"), which is saturated with colloidal graphite. The five automatic machines are used only 60 percent of the time during a one-shift workday.

3. Wire Department

With the exception of one shop, this department had been completely dismantled.

The filament wire for the lamp spirals is manufactured from the tungsten rods described above. Manufacture consists of a long series of complicated processes which are quite expensive.

The rods are first heated and reduced to 3-millimeters' diameter by circular forging machines; 22 steps are required for this process. The forge hammers operate at 3,000-5,000 strokes per minute.

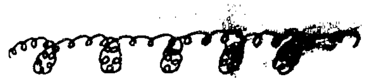
In eight coarse-drawing units, the wire then undergoes a reduction in diameter of about 10 percent per operation by being drawn through hard metal dies, until a diameter of 0.2 millimeter is reached. The speed of the operation is approximately 3 meters per minute. One man operates two units.

Seventy-five fine-drawing units are used for the final drawing, which reduces the wire to a filament; 0.3-0.5-carat diamonds are used for the dies. One woman can operate five units.

The thickness of the wire is not measured with a gauge but by weight. Six torsion scales are available for this weighing (the make is not known, but is probably Hartmann & Braun, Frankfurt/Main). The most accurate of these scales is calibrated to 0.2 milligram for each mark on the scale. An electric vibrator is built into each scale to prevent bearing friction in the scale and is activated at each weighing.

After the final drawing, the wire is wound into spirals. In general, the distance between windings is 0.8 times the thickness of the wire. The windings must not touch at any point, so that the bulb will retain the correct resistance. Sixty winding machines (about 3,000 revolutions per minute) wind the wire on iron cores. Double spirals are used for lamps above 100 watts:

single winding



double-spiral winding

At present, the 15 double-spiral winding machines are in use only about 30 percent of the time. The various machines give satisfactory service, but their construction and general operation cannot be compared to that of the old Osram machines. Because of the complete dismantling of the entire spiraling unit, it was necessary to rebuild the equipment completely.

To remove tension and establish a state of crystallographic equilibrium, the spirals are subjected to heat treatment. Seven continuous annealing furnaces are used, some heated by gas, others by electricity. Preliminary heating is done at 1,100 degrees C, tempering at 1,400 degrees C. After annealing, each spiral is tested for exact measurements, pitch, etc. Eight rather primitive microscopes with fixed vertical tubes are the only equipment available for making these measurements; magnification is 80-100.

Support wires for the spirals in the bulbs also serve as conductors for the current. These wires are either of molybdenum or of iron wire with 0.002-millimeter nickel plating. The plating is done in a machine built at the plant, which is primitive but gives excellent service.

The electrodes consist of three different wire parts welded together: ends of bare copper wire (soldered to the base); center of so-called Finkh wire (iron-nickel alloy, copper coated, with the same coefficient of expansion as the glass base); and upright wire inside the bulb, of nickel-coated iron or molybdenum.

Welding is done in 36 completely automatic machines which survived from the old Osram plant. One woman worker operates two or three machines; the output is 50 pieces per minute for each machine.

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4. Bulb Department

a. All-purpose bulbs are assembled and finished by completely automatic or semiautomatic machines. The machinery for a complete cycle of manufacture is called a group. Each group includes:

(1) Machine which cuts off the glass tubing for the pinch base and presses the dish-shaped foot against it.

(2) Machine which fuses together the glass rod, the dish foot, and the tube for evacuation. The electrodes are put in place and pressed in, and the pumping hole is blown.

(3) Machine which installs the support wires, bends them, welds the spiral, and threads the spiral on the support wire.

(4) Machine which stamps the bulb type, evacuates the bulbs by the flush method (i.e., alternating high and low pressure, which eliminates possible air bubbles), and seals off the pump tube.

(5) Machine which cements the base. Following the cementing of the base, the copper electrodes are soldered on by hand.

(6) Machine which tests the bulbs. The bulbs are put in the machine by hand and are also packed into cartons by hand.

All machines have been newly built, but some of them were mounted on bases which were still in good shape.

As mentioned earlier, there are three groups in operation and five more are being built. It should be mentioned that machines are no longer being built which combine pumping and fusing operations. The use of two separate units, one to evacuate the bulb and the other to seal off the tube, eliminates many breakdowns and makes maintenance easier.

b. Miniature bulbs. All operations are done by hand except the blowing of bulbs, which is done automatically. A semiautomatic machine, much simpler in design than the automatic machines, is available for fusing and attaching the socket.

c. Fluorescent tubes. The tubes are cleaned by hand. The fluorescent material is mixed with an ether solvent in four quite primitive shaking units and put into a wide-mouthed bottle. The stopper of this bottle has a hole big enough to admit the tube so that the end of it can be immersed in the solution. When air is forced into the bottle, the solution rises in the tube until the pressure is stopped (by means of a hand-operated cock). The solution then runs back into the bottle and some of the fluorescent solution adheres to the tube wall. After this first coating has dried, the process is repeated. The apparatus consists of three tables, each with a glass container, an air-pressure line, and a drying rack. The fluorescent coating is baked on in a gas-heated drying chamber with roller grate.

Installation of the sockets with the spirals is done at individual, well-equipped work tables which are connected by a conveyer belt. Two sockets are needed for each tube. An automatic machine fuses them into the tube. The machine, of recent construction (1949), turns out 200 tubes per hour. Evacuation and filling with argon gas is done at five separate tables (pumping time, 5 minutes per tube). The tubes are tested for leakage and lighting at a very primitive testing table, but testing with low and high voltage is done at a very well equipped semiautomat. This is followed by a final testing lasting 5 hours.

E. Production Materials

Copper wire is obtained from the former Vogel plant in Koepenick. The supply is ample.

Finkh wire (iron-nickel alloy with copper coating) is obtained from West Germany.

Seventy-five percent of the amount of tungsten wire needed is produced locally and is drawn to the required thickness. Enough machines are available to supply the demand for fine drawing, but forging and coarse drawing are inadequate, and additional amounts must be obtained from West Germany.

There is still a fairly good supply of tungsten ore (scheelite) and tungstic acid (WO_3) on hand, but some additional shipments of WO_3 are being obtained from various sources. Obtaining scheelite from China is one of the most important reasons for a trade agreement between China and the Soviet Zone.

Glass bulbs of magnesium-silicate glass, as well as exhaust tubes and glass rods, come from the former Osram Glassworks at Weisswasser, in adequate quality and quantity.

Glass tubing for the pinch foot is also obtained from Weisswasser, and for a long time has been a source of dissatisfaction. In the past, the so-called M-glass (31 percent lead) was used, but this is unobtainable now in the Soviet Zone because of the lack of lead. The material which took its place, Type 352, with 16 percent lead, was fairly satisfactory (up to 15 percent waste), until 1949, when a crisis developed and the waste, because of faulty glass, mounted to 50 percent. After short periods in storage or in use, the glass foot developed fine cracks which caused leakage. The reason was that competitions and propaganda caused the workers in the glass department to nearly empty the glass vats instead of using only 60-70 percent as is usual. This led to a higher production, but also to a lowering of the quality, which could not be detected on superficial examination at the plant and became evident only in the finished bulbs.

Glass tubing for fluorescent tubes and miniature bulbs also comes from Weisswasser.

Socket cement, composed of shellac, titanium dioxide, rosin, and hexamethylene-tetramine, is manufactured in the plant itself. It is soluble in alcohol. The raw materials are supposedly obtainable in the Soviet Zone.

Rare (inert) gases such as krypton, helium, and argon, are not found in the Soviet Zone and must be imported from West Germany. They are therefore used in the smallest possible quantities. All-purpose bulbs are not filled with rare gases.

Fluorescent materials, such as zinc-beryllium 216 c, zinc-beryllium 216 k, magnesium tungstate, cadmium borate, etc., are all obtained from West Germany.

Mercury is imported from West Germany through legal trade channels.

F. Distribution of Products

In 1950, no more reparations orders had to be filled. However, the needs of the occupation forces and of the various Soviet offices have to be granted preference. Incandescent bulbs are a controlled item in the German Democratic Republic, and are therefore rarely found in retail stores. It is difficult to cover even the most urgent needs of the general economy (the people-owned plants complain bitterly over the short supply of light bulbs), and the people in general must buy either on the black market (bulbs produced in West Berlin or West Germany) or in the HO (Trade Organization) stores.

The shortage of bulbs is due in part to the fact that for years the bulbs produced were of inferior quality and had a short life span. Hardly anyone in the Soviet Zone can afford to burn more than one bulb at a time, and the people must be content to get one bulb at long intervals.

If it should be possible to produce 8 million bulbs in 1950, this would mean an average of 0.45 per capita, whereas, in normal times, Germany figured on 1.2-1.4 bulbs per capita. Also, the Red Army and the Soviet offices in the German Democratic Republic use about three to five times the former normal civilian consumption of bulbs. In 1949, 15 percent of the bulbs were exported (Sweden, Hungary, Switzerland), but since 1950, export has decreased to below 4 percent (especially miniature bulbs), because of high prices and poor quality. Prices for all-purpose and miniature bulbs are 25-30 percent higher than in 1938. Fluorescent tubes with coil now cost 30 Deutsche marks.

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