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ASSISTANCE IN THE PRODUCTION OF RUBBER ARTICLES

IS/TOG/75/003

TOGO,

TERMINAL REPORT

Prepared for the Government of Togo by the
United Nations Industrial Development Organization,
executing agency for the
United Nations Development Programme



United Nations Industrial Development Organization

United Nations Development Programme

ASSISTANCE IN THE PRODUCTION OF RUBBER ARTICLES

IS/TOG/75/003

TOGO

Project findings and recommendations

Prepared for the Government of Togo
by the United Nations Industrial Development Organisation,
executing agency for the United Nations Development Programme

Based on the work of Jose C. de Jesus, expert in
the production of rubber articles

United Nations Industrial Development Organisation
Vienna, 1977

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ABSTRACT

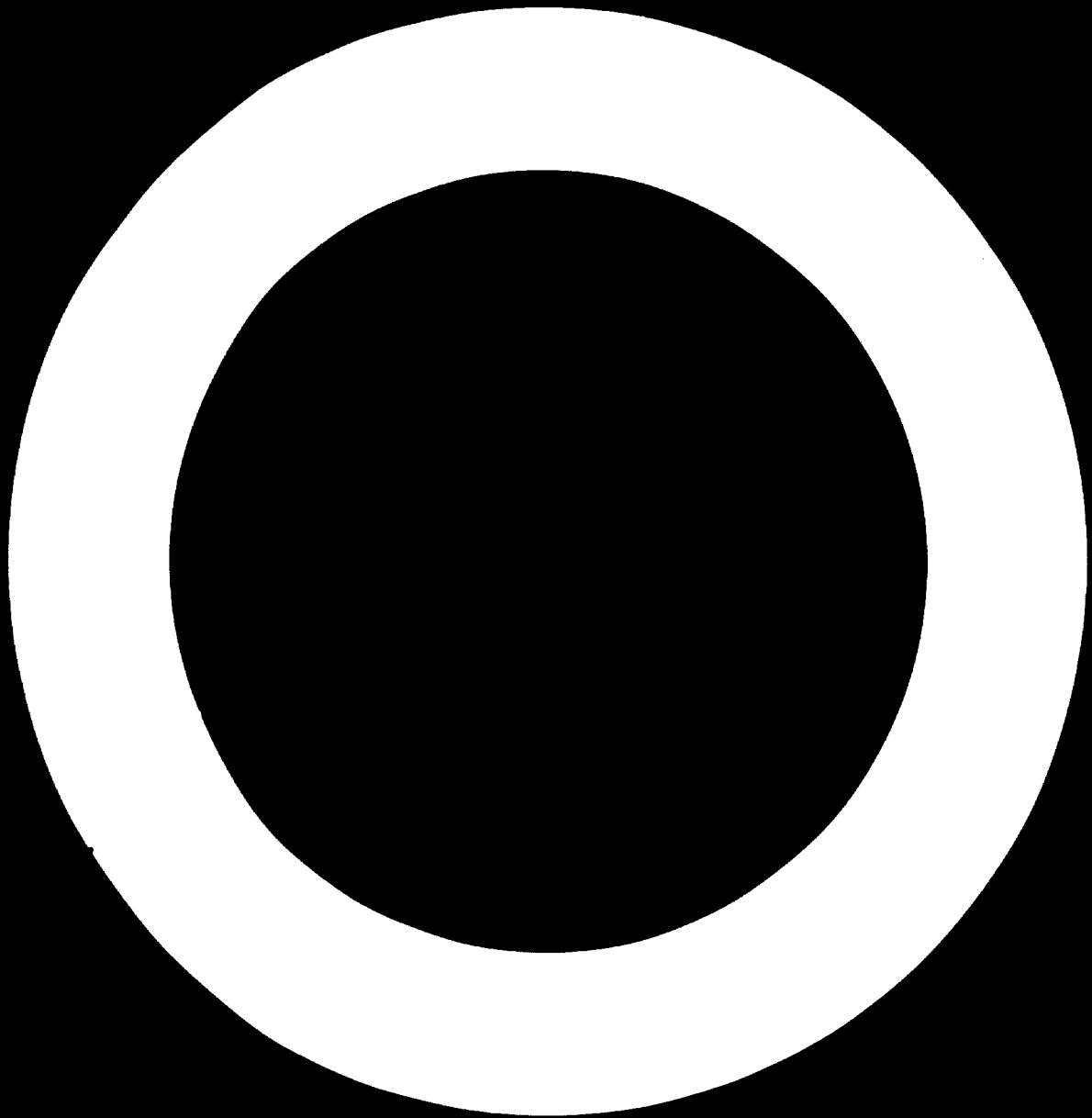
The project "Assistance in the Production of Rubber Articles" (IS/TOG/75/003) was launched on 17 April 1976 with the objective of assisting the rubber firm GENERALATEX to start the manufacture of certain rubber articles and of training Togolese technical staff.

The start of the project was somewhat delayed because of the late delivery of steam boilers. The first products were contact adhesive and camelback for the retreading of tyres. Production of contact adhesive was halted because of difficulties in obtaining raw materials, but the production of camelback is continuing, both for local consumption and for export.

The first bicycle tyres were produced at the end of January 1977. The item is now being mass produced. Preparations are likewise being completed to start production of bicycle and motorcycle tubes.

A system of quality control to improve the quality of finished products is envisaged and may soon be realized, if the amount needed to purchase essential test equipment is made available.

Training and organization of the local staff is continuously being followed-up. Fresh methods and techniques have to be imparted for every product added to the production line.



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INTRODUCTION

The project "Assistance in the Production of Rubber Articles" (IS/TOG/75/003) was requested by the Government of Togo in May 1975 and approved the following July by the United Nations Development Programme (UNDP). The United Nations Industrial Development Organization (UNIDO) was appointed executing agency. The project became operational upon the expert's arrival on the field on 17 April 1976. A total of seven months extension, expiring on 8 May 1977, was given to the expert after completion of his initial contract in October 1976.

The purpose of the project was to launch the manufacture of certain rubber products in Togo through the firm GENERALATEX. The short-term objectives were (a) to assist GENERALATEX to begin manufacturing; and (b) to train the Togolese technical staff. Long-term objectives were (a) the establishment of a system of quality control to improve the quality of finished products; (b) diversification of products; and (c) organization of production.

The UNDP contribution to the project amounted to \$23,000 for the first six months. An additional sum of \$16,400 was contributed for the seven-month extension.

Background of the project

GENERALATEX emanates from a group of promoters who, for three years, have been in the tyre retreading business. In order to assist the tyre retreading activities of the firm, NOSOREP, and to supply the Togolese market with rubber goods, the group, with the collaboration of the National Investment Society, decided to extend its activities to the following:

- (a) Production of camelback for retreading;
- (b) Production of bicycle and motorcycle tyres and tubes;
- (c) Production of shoe soling materials and allied products.

GENERALATEX is the first rubber industry of its kind to be established in the Republic of Togo and the project is the first to be launched in this industry.

Existing facilities

GENERALATEX, with office and factory in the UNIDO/CNPPME industrial estate in Lome, has the following machines and equipment to manufacture the above-mentioned rubber products:

Mixers. For mastication, mixing, conversion and warming of all rubber compounds, the factory is equipped with a IA swing-side discharge internal mixer and, an 18" x 36" mixing mill. Both machines are reconditioned.

Barwell ram extruder. This machine is used to produce profiles of camelback and tread rubber for bicycle and motorcycle tyres. It is also used as a tuber for producing air bags and bicycle and motorcycle tubes. The ram extruder runs intermittently and is suitable to short runs.

Tyre cord rubberizing unit. The unit consists of two mechanical dough mixers and a 60-inch spreading machine. The mixers are used to disperse the compounded rubber stock in naphtha to produce a smooth spreading dough. Spreading is effected by passing the tyre cord fabric and dough between rubber and steel rolls. The rubberized material is dried by passing through a steam-heated steel drum. Bias cutting of tyre cord is done manually with a pair of scissors.

Tyre building machines. The factory is equipped with a bicycle tyre building machine and a motorcycle tyre building machine. Each has a rotary drum whereupon, the different components of the tyre are assembled. A pneumatically operated rubber roll, pressing against the rotary drum, effects firm adhesion of the components.

Tyre curing presses. There is 3-daylight vulcanizing press for bicycle tyres and a 2-daylight vulcanizing press for motorcycle tyres. Both are mechanically operated, but final closing of the platens is done pneumatically. Compressed air is used to inflate the air bag for internal pressure. Both utilize saturated steam for heating.

Tube joining machine. Seamless bicycle and motorcycle tubes are produced by means of a pneumatically operated joining machine. Joining is effected by means of a vise after cutting with an electrically heated knife.

Tube curing presses. Curing of tubes will be done in manual presses of which there is one for bicycle tubes and another for motorcycle tubes. Both are steam heated types and will use compressed air for inflation.

Steam boilers. For generating steam for heating and curing, there are two identical, reconditioned boilers capable of delivering 5 to 6 kg/cm² steam pressure. The boilers operate semi-automatically and are fueled with diesel oil.

Air compressor. There is one that is big enough to supply all the compressed air requirement of the factory.

Belt conveyor. An improvised, constant-speed belt conveyor is being used to support the profiled goods during extrusion.

Bale cutting machine. A hydraulically operated, guillotine type bale cutter is used to produce convenient chunks of elastomers.

Water deaerating unit. Warm, used water from the mixing unit passes through a deaerating unit to cool during circulation.

Shawbury curometer. A Shawbury curometer has been acquired by the company. It gives information about the curing characteristics of vulcanizable rubber samples.

Rubber thickness gauge. This has recently been acquired and will be used to measure thicknesses of profiled bicycle and motorcycle treads and tubes, as well as that of rubberized tyre cord.

Dependatherm. This is a battery powered instrument used to determine mould temperature.

FINDINGS

A. Starting the industry

Facilities

A number of machines were either being installed or were being given finishing touches at the beginning of the project. Electrical installation of the mixers began when an engineer from the supplying company came over in June.

A number of additional facilities were requested after a survey was completed. A water deaerating unit to cool used water was recommended. Construction was immediately started and was finished in time. A proposed laboratory was also constructed. Upon suggestion, the rubberizing unit has been enclosed. The unit should have been installed in a separate building, since inflammable solvents are used during the operation. Additional vanes were recommended to be installed on the mixing mechanism of the dough mixers. These have helped avoid alteration of quality of the rubberizing dough as well as the loss of material when rubber compound which settles on the bottom of mixers is left undispersed. The rubberizing unit was also realigned since it has been observed to have been installed off-centre.

Among the number of items which have been lacking and were requested are the following:

(a) An air bag joining machine. An overseas inquiry did not yield any favourable result. An improvisation was thought of, using locally obtained materials. This device is now helping in the production of air bags;

(b) A rubber thickness gauge to measure thicknesses of profiled goods which have been received recently;

(c) A variable-speed belt conveyor which should have been bought with the ram extruder. A constant-speed conveyor was improvised which is now being used. Extrusion problems that are not being met with the extrusion of air bags are expected to arise in the extrusion of tubes which have relatively thinner cross sections;

(d) A stock dipping tank which was readily constructed and is now used to cool warm compounds sheeted from the mixing mill;

(e) Canvas trays for extruded rubber goods. These have been fabricated and are now used;

(f) Profile dies for extrusion. These are continuously being designed and cut.

Raw materials

Some items were found in stock while some were expected. Overseas orders were placed for additional items. A trip to Nigeria to buy a number of urgently needed items for the production of adhesives, camelback and air bags became necessary and was undertaken in the first week of May. A similar trip was made during the last week of September to search and purchase installation materials for the boilers. It became necessary to travel into the interior of the country in search of cheaper supplies of raw rubber.

Storage and handling of raw materials are closely supervised in order to prevent alteration of quality, spoilage and loss of materials.

Formulations and processing specifications

Formulae for all products are provided. These have been designed, taking into consideration ease of processing, economy and quality. Processing specifications are likewise provided and have been designed in accordance with machine specifications and prevailing operating conditions.

B. Training of the technical staff

Six men were found to compose the original staff. Since then the number of personnel has doubled. All initial work on trial runs and production were handled personally by the expert until such time that the staff assigned to specific jobs gained proficiency.

On the job training of all staff started immediately and was a daily activity from the beginning. On the spot instruction and demonstrations were held on the proper use of machines and equipment, and their maintenance. Observance of manufacturing methods and procedures was strongly emphasized, since errors can easily lead to loss of both materials and time.

At end of project the personnel numbered 12, and this was expected to grow to 30 to 35. Of the present number 3 are being trained for supervisory work.

C. Production of rubber articles

Contact adhesive

Contact adhesive was the first product to be manufactured. There was a favourable and encouraging response from users when a quantity of the product was introduced. Production has had to be set aside, however, first because of the raw materials needed, which have to be ordered in quantities larger than the expected periodic output, and secondly, the mixers are now fully utilized in the production of rubberizing doughs for tyres.

Camelback

The production of camelback started in the middle of July. Since then, the retreading firm, NOSOREP, has ceased to import the item from Nigeria. A substantial saving in production cost is being realized with the use of tyre buffings from the retreading shop.

The use of SBR (butadiene styrene rubber) has now started, with camelback for passenger tyres which require higher abrasion resistance. Camelback bought in Nigeria is produced wholly with natural rubber, because of high duties on imported synthetic rubber. The consumption of the firm, NOSOREP, is increasing because of the growing awareness of vehicle owners of the benefits in the use of retreaded tyres. Foreign markets are being explored and orders are expected.

Bicycle and motorcycle tyres

Production of bicycle and motorcycle tyres started as soon as steam for curing became available during the last week of November. The two boilers were delivered in September and it took some time to put one into operation and to instal the distribution lines and condensate return system.

Technical problems were encountered earlier in the production of air bags for internal pressure. Most have been overcome and air bags for bicycle tyres are now produced with ease. The first bicycle tyres were produced on 25 January; size 26 x 13/8 is at present being mass produced. A second size, 28 x 1 1/2, is still being withheld, because of an apparent error in the relative designs of the tyre mould and air bag mould. Efforts are now being exerted by the management to have this error rectified by the supplier in Japan.

Trial runs on the production of motorcycle tyres have also started, with emphasis on production of air bags for these tyres, for which the requirements are much more severe than in the case of air bags for bicycle tyres. Production will commence as soon as a good number of air bags have been perfected.

Bicycle and motorcycle tubes

Preparations for the eventual trial runs and production of bicycle and motorcycle tubes are finished. Dies and mandrels for tube extrusion are ready, but may need some necessary adjustment after the trial runs. The thickness gauge has recently been received. Compounds for both bicycle and motorcycle tubes have been formulated.

CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

Starting of work was somewhat delayed because of late supply of electricity to run the machines and late deliveries of steam boilers. Contact adhesive, which was the first product, was produced and introduced to the market in June. Since the middle of July, camelback has been continuously produced for local consumption and for export. Bicycle tyres are being mass produced.

Although there is an apparent shortage of trained personnel in the rubber industry in the country, the problem of manning the industry is being overcome. Intensive training of the staff which began immediately at the start of the project is being followed up. The staff now composing the whole set-up have shown significant progress in their respective jobs as far as the present production operations are concerned.

There is still much to be desired as far as the system of quality control is concerned. Because of the absence of necessary test equipment and indicating instruments in the processing machines, progress along this line is hindered. It is hoped that the situation will soon be alleviated, when the articles of equipment requested by the expert are received and the indicating instruments are restored.

Diversification of the industry's products faces bright prospects. Enquiries for the supply of specific rubber articles are beginning to be received and are being studied.

B. Recommendations

1. The mixing unit

An additional mixing mill of a higher capacity than the existing one is highly recommended. The mill should be of a lower speed and should be able to admit stocks without premilling in the internal mixer. The present practice, whereby stocks are passed through the internal mixer because the mill is not strong enough, has some disadvantages.

Overmilled stocks yield finished products with degraded physical properties. The practice is also uneconomical. The additional mixing mill will also help overcome bottlenecks resulting from interruptions due to breakdown.

The emergency brake of the present mill should be restored and the steel post in front of the rear roll, which hinders the operator's progress, should be removed. The improvised chute used to convey mixed stock from the internal mixer to the mill should be modified in such a way that no particle of rubber is caught between the mill shafts or is dropped on the floor where dirt is picked up. The indicating instruments of the internal mixer should be restored for much needed information. Restoration of the emergency brake of the internal mixer should also be considered.

As a matter of practice, the mixing unit as a whole should be enclosed or completely segregated from the rest of the outfit. Emissions from the mixing process are injurious to products-in-process, especially those which need to be assembled, to the workers' health and to the mechanisms of other equipment.

2. The extruder

It has been shown that the profiling of cycle treads with the ram extruder, besides being extremely time-consuming, also produces a considerable amount of remilled stock. This has resulted in dimensional variations of profiles. Another disadvantage is the degradation of the physical properties of the finished products. The trial run of the tube extrusion has also shown the difficulties, particularly with the cumbersome method of adjustment of the die to obtain uniform cross sections.

It will be useful to consider acquisition of a screw type extruder of convenient size for profiling and tubing. The screw type extruder has the advantage of continuous runs and easily controlled precision. A variable-speed conveyor always goes with it.

3. Tube curing presses

Automatic tube curing presses are widely used because the tubes produced are highly competitive and are of better quality. It has also been found that the proportion of output, tube to tyre, is three tubes for every tyre. It is foreseen that the manual presses will be inadequate to meet the projected volume production.

4. Profile bars

We have experienced considerable loss of time in the use of locally obtained profile bars which cannot withstand the pressure of the ram extruder. The bars bend under the pressure after a number of extrusions, thus altering the dimensions of extrudates. Tempering the steel bar before cutting the pattern renders it unworkable, while tempering the same after pattern cutting tends to twist the metal, thereby altering the design. A lasting solution is to acquire the same profile bars supplied by the ram extruder manufacturer, and which are now being used for camelback extrusion.

5. Tyre cord liners

Baft used as liners for rubberized tyre cords has resulted in the contamination with cotton linters, which are predominantly visible in the cured tyres. The use of baft has also resulted in wastage of some quantities of rubberized tyre cords. The use of teflon-coated liners is worthy of consideration.

6. Steam inflation

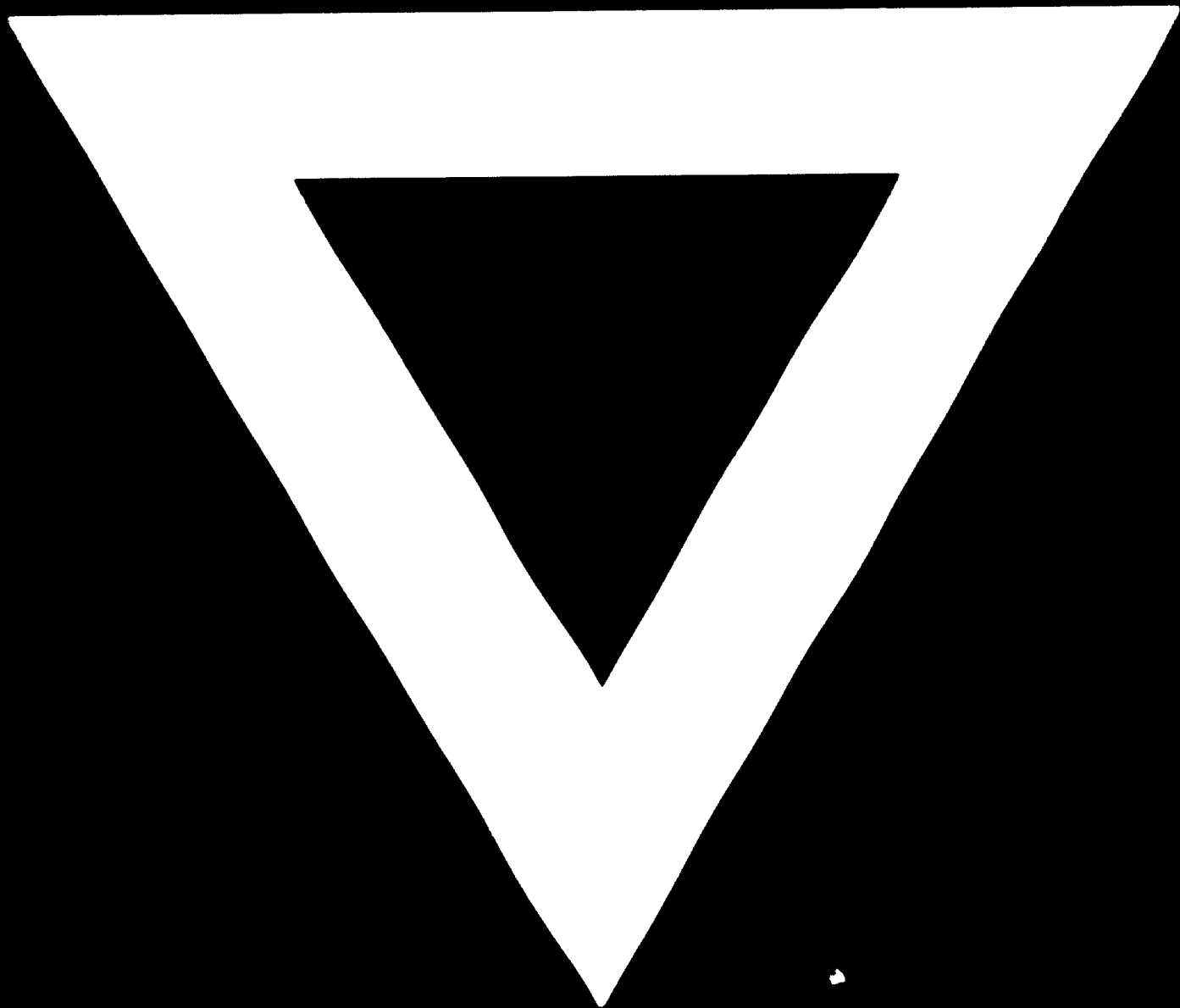
Steam inflation has largely replaced air inflation in the tyre and tube curing. Besides higher output, better product quality is realized. Only slight modifications in the system is necessary to convert air inflation to steam inflation in the curing presses. Benefits are sure to be derived, especially in the curing of air bags which take hours.

7. Mechanical workshop

A mechanical workshop equipped with a few essential machines is necessary. Modifications and repairs may be profitably executed.



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