

FRICHS

Standard Diesel

Informationsmateriale til ORE

1956

Fra Jørgen Christensens dødsbo.

Leveret af Viggo Hejlesen.

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DERES REFERENCE: ORE/B13/11.719e. VOR REFERENCE:

DEN 15.3.56.

Dear Sirs,

Re: European Standard Diesel Locomotives.

We thank you again for your letter of the 20th July, 1955, reference as above, regarding your general invitation to Industry to submit proposals for diesel standard locomotives classified as c, d, e, and g in the "Table of General Characteristics of Diesel Locomotives to be standardized in Europe" and have pleasure in sending you together with this letter our technical proposals for standard diesel locomotives class d and e.

Our proposal for standard diesel locomotives class g will be forwarded as requested before the end of March.

As will be seen from the following information our technical proposals for standard diesel locomotives of the classes d, e and g have been based directly on the design of diesel locomotives previously built by us or which we have now on order.

Regarding class c, however, which on account of its wheel arrangement would offer definite advantages to the hydraulic or mechanical transmission system, we have no corresponding basis of experience from existing types and therefore ask to be excused for not presenting a proposal for this class of locomotive.

Our proposals for the three classes d, e and g as well as the present letter is forwarded as requested in several copies as follows:

- 6 copies in English,
- 5 copies in German,
- 9 copies in French,

and we have strived to make our proposals as far as possible in the form and order of chapters required in your document II.

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Before going into more details regarding each of our three proposals we have pleasure in giving the following general information as asked for in your document I.

General Information.

1. We are in agreement with the aims defined in your above letter and also with the manner agreed between ORE and Industry regarding proceedings for the Standardization of Diesel Locomotives.
- 2-4. In the case that one or more of our proposals would be selected as standard types or as a basis for the design of standard types of locomotives we would be prepared to seek, in cooperation with ORE and with other European locomotive builders the basis of a rational construction of these types of standard locomotives in the various countries.

It is understood, however, that the above relates only to the design and general arrangement of the locomotive. Details of licence arrangements and amounts of royalties cannot be fixed until after the conclusion of the competition and determination of the purchase programme.

For diesel engines, transmissions, auxiliary equipment, special devices etc. we shall treat the question in accordance with the usual possibilities and customs of trade.

In this connection, we refer to the minutes of the 3rd ORE-Industry meeting held in Utrecht on the 20th and 21st May, 1955.

- 5-6. Regarding our achievements and experience with the construction of Diesel Locomotives which date back to 1925 we refer to the attached list of references, and the photographs accompanying same which show examples of the variety of Diesel Locomotives and Railcars built by us, with an aggregate horse power of 165.000.

The list of references gives details of the Railway Administrations and Undertakings operating each locomotive and railcar and also of the year of order and the corresponding numbers of vehicles.

We may draw particular attention to the fact that we have been entrusted as early as 1930 with the supply of six 1000 and one 1600 b.h.p. diesel electric locomotives to the Royal State Railways of Siam (photo No. 1981). With few exceptions, caused by war damage, these locomotives are still in service. At about the same time we delivered two 1000 b.h.p. diesel electric locomotives to the Danish State Railways (photo No. 1800 and 1802).

From that time and until 1939 we built a further number of diesel electric locomotives of varying types and sizes (photo No. 1827) mostly for Danish privately owned railways, but during that period we had to concentrate more on the construction of heavy diesel electric passenger railcars than on the further development of regular diesel locomotive types without passenger accommodation.

In 1933 an order was received from the Danish State Railways for ten 480 b.h.p. diesel electric railcars of a new type with two diesel engines and main generators both mounted on one of the bogies.

This railcar type has been retained by the Danish State Railways for more than 20 years as a standard type used for main line express services as well as for mixed trains on main and secondary lines.

For the following series of railcars of this type the diesel engines were redesigned to give an increased output of 550 b.h.p. for the two engines and at the same time the electric transmission was modified in order to meet extended requirements regarding train hauling capacity.

The total number of railcars of this type delivered to the Danish State Railways has now reached 139 and a further number of 5 railcars remain to be delivered this year (photo No. 5748).

The diesel electric articulated high speed trains of which four were delivered to the Danish State Railways in 1935 and four again in 1937 have engines of the same type and more or less similar transmission and control systems, (photo No. 2921).

During the second world war and the first post-war years we had to take up again the production of steam locomotives which had been given up since 1930, and during this period our production of diesel locomotives and railcars reached small figures only.

From 1947 and onwards, however, supplies of diesel electric railcars for the Danish State Railways have again been regular, and in 1950 orders were received from Danish privately owned railways for a number of diesel electric locomotives of two different types of 750 b.h.p. (or 550 b.h.p. without supercharging) and 375 b.h.p. respectively (photos No. 5435, 3463, 5593 and 5599).

The latest orders obtained from the Danish State Railways for two 1760 b.h.p. and two 400 b.h.p. diesel electric locomotives corresponding to ORE class "g" and class "b" respectively will be dealt with in the following paragraphs.

7. As will be seen from the list of references the largest series of main line diesel railway vehicles we have built until now are several series of 550 b.h.p. diesel electric trailer-hauling railcars for the Danish State Railways of 20 railcars each and most of these series have been delivered within a period of approximately six months. The railcars are equipped with diesel engines of our own design and manufacture and with automatic oil-fired train heating boilers.

8. As requested, we state below the names of the plants where the main items of equipment for the locomotives are constructed:

Diesel engines: class d and e: Frichs
class g: Frichs
(engine design = Burmeister & Wain)

Engine turbochargers:	Brown Boveri or Napier
Main generators and traction motors	Titan or Thrige
Electric auxiliary equipment:	Titan or Thrige
Electric control system:	ASEA
Air brake compressors:	Atlas Diesel or Knorr
Train heating boilers:	Vapor Clarkson

We refer to the information given under point 2-4 above.

Having given the above information about our general background of experience as asked for in your "document I" we would like to add some remarks more particularly associated with our proposals for standard locomotives class d, e and g.

Proposal for Standard Locomotive Class d.

Regarding our proposal for this class of locomotive we refer once more to the six 375 b.h.p. diesel electric locomotives ordered by Danish privately owned railways in 1950 and delivered in 1953 the delay being caused by difficulties with the supply of the electrical equipment.

The general appearance of this type of locomotive is shown on photo No. 5599. The wheel arrangement is B-B with nose-suspended traction motors with double reduction gearing on all four axles. The diesel engine is a 6-cylinder, 4-stroke vertical engine with turbo-pressure charging (photo No. 5472).

The locomotive has a weight of about 40 tons in working order and the transmission characteristics have been chosen so as to comply with the requirements of the railway companies in question.

When the above locomotives had been completed negotiations were taken up with the Danish State Railways about the possible supply of similar locomotives, but in the meantime the programme for a European standardization of diesel locomotives had been established and we were asked to make a modified proposal for a locomotive type corresponding to ORE class b and with transmission characteristics as specified for this class of locomotive.

In view of a possible unification of diesel engine types for ORE standard locomotives from class a and b and upwards we gave up the engine type used for the above Danish locomotives, and in order to obtain a maximum of range of output with the same cylinder unit and also in order to comply with the requirements regarding the visibility of low signals and of obstacles near the track we decided to build a V-type engine with a nominal output without pressure charging of 50 horse powers per cylinder or 400 b.h.p. for an 8-cylinder V-type engine.

The same 8-cylinder engine with 50 % pressure charging would thus give an output of 600 b.h.p. corresponding to the requirements

for class c and d and a 12-cylinder engine with slightly less than 50 % pressure charging would cover the requirements in the case of class e.

In October 1955 we obtained an order from the Danish State Railways for delivery of two 400 b.h.p. shunting locomotives to be built in conformity with the requirements stated for ORE class b locomotives. These locomotives are now under construction in our works.

Our present project for standard locomotives class d is therefore a further development of the above class b locomotives and has been worked out in close conformity with the stipulations in your documents II and III.

The technical description of our project has been set up in conformity with "Document II part B" the sequence of which we have followed as closely as possible.

Taking into consideration our experience with the class b locomotive and the requirements given for class d and e we have tried to accomplish a thorough coordination of designs in the planning of the class d locomotive in order to make use of common construction elements for this type of locomotive and for class e.

The following survey will show which construction elements are common for class d and e locomotives.

Bogies.

Firstly it has been possible to make the bogies identical for both classes in that the

- the bogie frames
- the wheel pairs
- the axle boxes
- the spring system
- the brake system

are of the same design and dimensioned for an axle load of 18 tons.

The brake gear is arranged in such a way that the percentage of braking may be adjusted to a constant figure for axle loads between 15 and 18 tons by a single change in the brake lever system.

The spring system further allows the buffer height and the vertical clearance for the axle boxes to be kept constant for axle loads between 15 and 18 tons by adjusting the spring suspender nuts.

Superstructure.

As may be seen from the assembly drawings No. 200L-900 and 200L-920 the two classes of locomotives have been given the same overall dimensions and the following parts are identical

body underframe
driving cab
engine end bonnet
generator and cooler end bonnet

The body underframe has been designed to withstand lifting at the buffer beams with a load corresponding to 18 tons axle load.

The generator and cooler end bonnet offers space for the train heating boiler in the case of class e and the cooling plant also has been made identical in both cases except that class d is fitted with single radiator elements whereas class e has double elements.

Diesel Engine.

The diesel engines of class d and e are built up of exactly the same cylinder units and differ only regarding the number of cylinders.

Of the principal engine components it is thus only the crank cases, the crank shafts, the cam shafts and the turbo-pressure chargers that are different in the two cases.

Electrical Equipment.

The following parts of the electrical equipment are identical for class d and e:

traction motors
traction motor blowers
generator blowers
cooling fans and motors
motors for fuel transfer pumps
motors for lubricating oil pumps
several parts of the control equipment.

Regarding the traction motors we would add that the unification of traction motors for class d and class e locomotives has been made possible by the fact that the two locomotive types have the same maximum speed of 80 km/h whereas the minimum speed at continuous rating is 12 km/h for class d and 15 km/h for class e.

Proposal for Standard Locomotive Class e.

As will be seen from the foregoing paragraphs class d and class e are virtually the same locomotive type in that very few components are different, first of all the diesel engine and the main generator. Many diesel engine components, however, and especially those who may have to be replaced in due course are identical in both cases.

The arrangement of auxiliaries such as compressed air containers has been modified from class d to class e on account of the installation of a train heating boiler in the class e locomotive.

Proposal for Standard Locomotive Class g.

As mentioned on page 2 of this letter we have built diesel electric locomotives of 1000 and 1600 b.h.p. respectively already 25 years ago.

After that time, however, our efforts had to be more concentrated upon the development of railcars and articulated high speed trains and of engines particularly suitable for this kind of traction.

During the war-years and for some years afterwards we had no possibility of extending our experience with heavy diesel locomotives nor to develop suitable engine types for main line locomotives whereas within the same period development of diesel traction in the United States proceeded rapidly and experience was gathered which as it became known to European railways made it obvious that a rapid replacement of steam traction by diesel traction was not only an attractive possibility from a purely technical point of view but more or less an economic necessity.

In this country the Danish State Railways soon decided to extend their existing diesel services by the procurement of heavy main line diesel locomotives, and as it is now generally known they were pioneers in introducing one of the most popular American diesel locomotive types in Europe.

At the same time it was a general desire that such parts of the locomotive which could be made in this country should be ordered with Danish Industry and that as soon as possible a purely Danish locomotive should be designed to comply with the specifications of the Danish State Railways or as the ORE specifications came into existence corresponding with the specification for ORE class g.

By that time we had no fully established engine type with an output sufficient for a class g locomotive with one single engine. This above all was a consequence of the preference which had been given in this country to the principle of deviding the required engine output between two or, as in the case of the Danish high speed trains, even between four engines, a principle that had been followed for a long time and appreciated for several reasons.

Messrs. Burmeister & Wain of Copenhagen, however, had developed a 2-stroke V-type engine with an output of 110 b.h.p. per cylinder or 1760 b.h.p. for a 16-cylinder engine, and in the end of 1953 an agreement was made between Messrs. Burmeister & Wain and us to the effect that we obtained the right to build this engine type for railway traction purposes.

A few months later in March, 1954, we obtained an order from the Danish State Railways for two diesel electric locomotives with FRICHS-B&W engines of the above type.

The first of these engine has been running on our test bed since the beginning of January of this year and is expected to have passed the 100 hours test according to UIC specification No. 623/o before the end of March (photo No. 5974).

We expect that both locomotives will be in service within two or three months thereafter.

The mechanical part of the locomotives including the bogies are of our own design, and the general arrangement as well as the electric control scheme has been made by us in cooperation with our sub-contractors, Messrs. A/S Titan, Copenhagen, for the electric generators and traction motors and Messrs. ASEA, Västerås, Sweden, for the electric control equipment.

Regarding further information concerning the construction and arrangement of the locomotives proposed as standard locomotives of the classes d, e and g we refer to the technical specification and the drawings belonging to same.

Prices and Commercial Conditions.

Having now replied to your "Document I" and given some general information about the background of each of our three proposals for standard locomotives of the classes d, e and g we may give you as requested the approximate prices per unit of each of the three types each based on the assumption of an order of 50 units for the type concerned.

The prices which are in no way binding have been calculated as per January 1st, 1956.

Calculation of the prices has been based on delivery ex works of the fully equipped locomotives without packing, the diesel engines without lubricants and fuel tanks empty.

The prices do not include any spare parts or supplementary accessories except small tools to be carried in the locomotives with regard to the daily maintenance.

The delegation of technical staff and instructors is not included in the prices.

Otherwise the prices have been calculated as if they were for the railway administrations of this country.

Under these conditions the prices will be approximately as follows:

for class d	=====	d.kr. per locomotive
for class e	=====	d.kr. per locomotive
for class g	=====	d.kr. per locomotive

As previously mentioned the prices are based on conditions prevailing in this country as per January 1st, 1956, and are subject to revision.

In case of an order being placed the price revision formula will have to be agreed upon by the contracting parties.

Regarding terms of payment we suggest that payment should be made as follows as in the case of previous orders received from Danish and foreign railway administrations:

- 1/3 by the signature of the contract,
- 1/6 when the wheel sets have been delivered and the principal plates for the locomotive bodies and bogies have been prepared for assembly,
- 1/6 when the crank shafts for the diesel engines are available and the engines are ready for assembly,
- 1/6 when the diesel engines and generators have been tested on our test bed with satisfactory results,
- 1/6 when the complete locomotives are ready for delivery ex works.

We may suggest that the second and third instalment is paid at one time for groups of 5 or 10 locomotives whereas the fourth and fifth instalment should be paid for each locomotive or by the way of monthly accounts.

If requested a bank guarantee amounting to 5 % of the value of each locomotive may be delivered against payment of the last instalment to be valid during the period of guarantee.

This period is understood to be limited to the time required for a maximum run of 150.000 km per locomotive or a maximum duration of one calendar year, the guarantee to expire as soon as either one of the above circumstances has occurred.

The date of origin of guarantee may be subject to further agreement between the contracting parties but should not be later than the day when the locomotive goes into service.

Regarding the extent of guarantee we undertake to repair, modify or replace at our works within the shortest possible time any part of the locomotive that may show defects as a result of faulty workmanship, design or materials within the period of guarantee, such defects to be immediately notified to us.

Expences for dismounting and reassembling as well as any costs of transport are to be borne by the purchaser. This applies also in the case of a complete locomotive having to be transported back to our works for repair. Replaced parts become our property.

We are not responsible for consequences of unavoidable circumstances, faulty handling, neglecting of technical instructions, use of unsuitable fuels, lubricants or cooling water or otherwise of ordinary wear and tear. The renewal of parts which are regularly

consumed such as lamps, fuses, carbons etc. are excluded from the guarantee.

We shall not carry any liability in respect of other direct or indirect damages such as interruption of service etc.

In the case of any modifications being made by the purchaser or by third party without our agreement we shall become free of any further guarantee obligations.

We presume that in the case of an order being placed the sales and delivery conditions will be subject to further negotiations.

The prices include a relative share of the cost of development and designing as well as special production tools, jigs, patterns etc.

The figures of the prices are not inserted in this letter but are stated in a separate letter to the President of ORE according to instructions given in your letter of the 20th July, 1955.

We hope that our present letter in connection with the specifications and drawings of each of the locomotive types will give you all information that is necessary for the investigations to be undertaken by ORE. We trust that our proposals will be favourably considered.

Should any further information be required we are ready to put this at your disposal in what way you prefer either by sending in supplementary specifications and drawings or by putting ourselves at your disposal for a verbal discussion of any point which we may not have succeeded to make sufficiently clear.

Yours faithfully,

A/S F R I C H S