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AKTIEBOLAGET **VOLVO** GÖTEBORG

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Aktiebolaget Bofors
 BOFORS

AKTIEBOLAGET BOFORS
 12 MRS 1966
 HAFT DEL
 SVAR

Från referens

Vår referens

Datum

6700-95-SÅR/Lo

11.3.1966

Attention: Ing. O. Engman

MA1 OCH MA2 - ÄNDRAT UTFÖRANDE K60-MOTORN

Refererande till telefonsamtal mellan Eder ing. Engman och vår ing. Rosell översändes härmed kopia av Rolls Royces brev av den 9.3.1966 vari Rolls Royce bl.a. redogör för skillnaden mellan K60 Mk 40 K och Mk 10 resp. mellan Mk 10 och 275 hk-utförandet.

Vi emotse med intresse Edra synpunkter.

Behandlas av	Dat.	Signatur
RMO	16/3	
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RMT	-4-	
På	-4-	
KKK	14/2	gn Sna

See

Högaktningfullt

AB VOLVO
 Avd för Hydr Växellådor
 och Turbomaskiner.

S O Kronogård

S O Rosell

Följ nr K11808
 C.
 Behållare Hde

Bil. enligt ovan

cc. Ing. E. Hedenqvist, AB Bofors
 Kapt. K O Österlund, AB Volvo

S Å Rosell
 66/95



ROLLS-ROYCE LIMITED

MOTOR CAR DIVISION
CREWE
ENGLAND

TELEGRAMS:
"ROYCRU CREWE"

TELEPHONE:
CREWE 55155
TELEX: 36121

OUR REF. DP/Sm. 9/MHL.

YOUR REF.

9th March, 1966.

Mr. S.A. Rosell,
Aktiebolaget Volvo,
Box 382,
Göteborg 1,
SWEDEN.

Dear Mr. Rosell,

Mr. West has discussed with you by telephone the advantages of adopting the Mark 10 engine and this letter is to set down in some detail the features and advantages of this engine. The Mark 10 engine is the product of continued development of the 40K engine and has been the subject of intensive development work over recent months. It is the basis for all current development work on higher powered engines for the British Government.

Differences

A - Between K60/40K and Mark 10

The Mark 10 engine is very similar to a Mark 40K but with the following changes.

- (i) oil-cooled pistons and associated drilled con-rods would be fitted;
- (ii) an automatic timing device would be fitted;

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- (iii) the scavenge blower would be smaller having only 80% capacity of the Mark 4OK blower;
- (iv) larger hole injector nozzles would be fitted;
- (v) the crankshaft phase angle is increased from 11° to 16° .

B - Between Mark 10 and 275 BHP engine

It must be emphasized that the Mark 10 engine incorporates the fundamental requirements of the 275 BHP engine in that it includes oil cooled pistons, the same scavenge blower and crankshaft phase angle. It follows that the conversion of a Mark 10 engine to a 275 BHP turbo-charged engine becomes more simple and involves,

- (i) the fitting of 2 CAV turbo-chargers and their associated ducting and pipes;
- (ii) the fitting of a modified injector pump and modified nozzles.

Advantages

One advantage of adopting the Mark 10 engine has already been stated, that is ease of conversion to 275 BHP engine. There are other important advantages.

- (i) better specific fuel consumption which mainly results from reduced blower work;
- (ii) the improvement in (i) makes life easier for the pistons;
- (iii) the heat rejection is less than a Mark 4OK with oil-cooled pistons;
- (iv) in addition to (ii) the oil-cooled pistons give improved reliability.

Prices

We have already quoted (letter reference DP/Sm. 7/IP. 9.2.66) a price of £2,272 for a 275 BHP engine built at Crewe.

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This price remains unchanged. Using a comparable basis the price of a Mark 10 engine is £1,962. 10. 0. which is almost £37 less than the present K60/40K fitted with nimonic crowned pistons. Although this is, of course, a little more expensive than the earlier "standard engine" price of £1,932. 10. 0. you will realise that much of the increase is accounted for by the inclusion of the automatic timing device, for which prices have already been given in Modification Proposal VAB 109 (E).

Conversion Costs

It is, of course, not possible for us to give accurate costs with regard to labour as we have assumed, simply in order to provide a cost comparison, that the work would be carried out in Sweden. We can only give estimates of the time we would expect each conversion to take.

In giving estimates of labour hours we have tried to take into account the conditions we think would apply to each exercise if it were carried out in Sweden. We have based the estimates for the conversion of the K60/40K to 275 BHP on the work carried out by our Service Engineers at Volvo recently. Nevertheless we cannot take into account all the local conditions which have a bearing on the work.

Our estimates are, therefore, as follows :-

- (a) Conversion from Mark 10 to 275 BHP engine,
 - Material - approximately £300
 - Labour - approximately 5 man hours;
- (b) Conversion from K60/40K to 275 BHP engine,
 - Material - approximately ~~£330~~ 860
 - Labour - approximately 75 hours;
- (c) Testing. We do not feel we can give cost estimates for acceptance test of engines but we would allow 35 hours

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for the test operation. This time includes rigging the engine on the test stand, a period for warming up, the acceptance test, a short preservation run and finally un-rigging the engine.

The conversion of the K60/40K to a 275 BHP turbo-charged engine clearly involves a greater number of labour hours as the engine has to be completely stripped to fit oil-cooled pistons in place of nimonic crowned pistons and to change the crankshaft phase angle. It seems sensible to reduce this problem as far as possible by adopting Mark 10 engine features.

K60/40K with oil-cooled pistons

Questions have been raised concerning the feasibility of fitting oil-cooled pistons to a K60/40K without the other features of a Mark 10 engine. We do not consider this can be recommended. The total heat rejection of the 40K with oil-cooled pistons is greater than that for the 40K with nimonic crowns and the heat to oil is greater than the net effect on the total heat rejection figures. We would consider, in the Volvo installation, this arrangement to be inadvisable.

In addition to the problem of heat rejection inherent in this engine a further problem arises when one considers converting such an engine to a 275 BHP version. We have already stated that the crankshaft phase angle is increased from 14° to 16° in the Mark 10 engine and that this increased angle is retained for the 275 BHP engine. It follows that, if the conversion were made from a 40K with oil-cooled pistons to a 275 BHP engine, the phase angle would have to be changed.

This change is associated with further changes to the combustion chamber shape such that the crown shape of an oil-cooled piston fitted to a K60/40K differs from that of an oil-cooled piston fitted to Mark 10 or 275 BHP turbo-charged engine. It is clear, therefore, that there are definite advantages in adopting a Mark 10 engine as soon as possible and minimising the cost of conversion.

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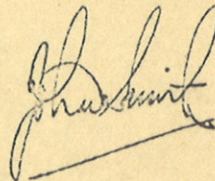
Conclusion

Rolls-Royce strongly recommend acceptance of Mark 10 between 62nd and 68th engine which can be achieved if a decision is made by 21st March 1966.

In conclusion we wish to emphasize the following points :-

1. The Mark 10 engine is a development of the 40K and is the basis for all current higher powered development of K60 for the British Government.
2. It is simpler and less costly to convert the Mark 10 to a 275 BHP version than it is to convert the present 40K.
3. The heat rejection figures for the Mark 10 are better than those for a K60/40K fitted with oil-cooled pistons, the total should be no worse than that for a standard K60/40K.

Yours sincerely,



JOHN D. SMITH.