ALLISON DIVISION

GENERAL MOTORS CORPORATION

INDIANAPOLIS, INDIANA

December 12, 1942

CABLE ADDRESS "ALLISONENG"

IN REPLY REFER TO RMH:me

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Commanding General
Army Air Forces, Materiel Center
Washington, D.C.

Subject: Service Use of High Power Outputs on Allison V-1710 Engines

Dear Sir:

I. In the past week we have received reports from both the Middle East and Australia indicating the use for considerable periods of time of very high manifold pressures on V-1710-F3R and F4R engines, (AAF models -39 and -73). From Australia we quote:

> "Some pilots admit operating for prolonged periods at around 70" Hg. (20 lbs./sq.in.) of boost",

and from the Middle East our Representative who just returned advises that they are resetting boost controls to 66" Hg. (18#/sq.in.) maximum boost pressure. The engines under discussion are of the *-F3R and -F4R type with 8.8:1 blower ratio on which this company has agreed to the war emergency operation at 60" manifold pressure (15 lbs./sq.in.boost) and approximately 1570 H.P. at 3000 R.P.M. As can be seen from the attached chart #C-234, two copies of which are enclosed, on the average engine 66" boost is approximately 1745 B.H.P. at sea level or 1770 H.P. at 2000 feet and can only be obtained either under ramming flight conditions at 3000 R.P.M. or by overreving the engine it can be obtained to considerably higher altitudes. In the case of the 70" boost this can only be obtained at sea level full out with at least 3000 feet of ram at 3000 R.P.M. and would require considerable overspeeding to obtain this manifold pressure at any altitude above sea level. As you can see at 60° F. or standard atmospheric conditions that this results in approximately 1780 H.P., although this may be reduced somewhat by either higher carburetor air temperatures or rich mixtures. Our dynamometer tests indicate

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at with the normal automatic rich fuel-air ratio setting
d without ram that it is necessary to run at 3200 R.P.M.
o obtain 70" manifold pressure resulting in 1780 actual
.P. at 75° carburetor air inlet temperature.

. While we cannot help but feel pleased that our engines
e standing up apparently to the particular squadron's sat-
faction under these conditions, we also cannot help but
eel that the selection of such high manifold pressures may
e based on inadequate testing and that they are very apt
o result in occasional failures which may occur some time
fter the operation at such high horsepowers but when oper-
ting normally or even crusing with resultant loss of pilot
nd aircraft.

j. We appreciate that the fighter units must of necessity
balance out engine performance against combat performance.
We understand that it is possible to rate the engine so
conservatively that the pilot may never win a battle and
be shot down frequently whereas if the ratings are increased
the engine life may be lessened but the pilot's chances of
life are greatly increased. We also appreciate that the
pendulum can swing too far in the other direction and believe
that this may be happening at the present time. We are
particularly concerned regarding the tendency of people to
whom we or our service men have talked to feel that once
a given manifold pressure has been pulled on an Allison
V-1710 engine that this is satisfactory proof that it can
be continued and used on any model engine. We have for
two or three months been producing our V-1710-E18 and -E19
and F20R model engines (-AAF -83, -85 and -81, respectively)
with 9.6:1 supercharger blower gears which, while resulting
in considerably better altitude performance, also result
in very appreciably higher mixture temperatures and greater
tendency to reach the detonation point of the fuel at lower
manifold pressures than obtained with the 8.8 blower ratio
above mentioned. We are attaching two copies of curve C-233
showing the unrammed and rammed manifold pressured available
at various altitudes with the 9.6:1 gear and the relative
positions of military take-off and war emergency ratings with
respect to what can be pulled out of the engine. In deter-
mining the 57" Hg. war emergency rated manifold pressure
Amendment 5 fuel was used and the detonation point was stayed
away from at 120° F. carburetor air temperature with the
engine running at 3000 R.P.M. The 60" war emergency rating

on the 8.8 blower ratio was somewhat further from the detonation point but was limited by structural limitations of the engine to the 60" value. We therefore feel that, with the tendency to pull out manifold pressure such as 66" to 70" on 8.8 blower, a bad precedent is being established which may cause numerous failures when the 9.6:1 supercharger gear ratio engines are received in the field. We consider it urgent that the Services be warned not to feel that when they can take out 66" from a certain model of V-1710 engine that this will be permissible on all models of V-1710 engines. It is obviously much more dangerous to take out high manifold pressure on the 9.6 blower gear engine than on the 8.8. Our tests indicate that under detonating conditions a hole can be burned in a piston which may result in seizing in the cylinder and breaking of a connecting rod in a matter of thirty seconds from the time detonation starts.

4. The importance of having the proper fuel at any point where war emergency rating is being used is also to be emphasized. We request that all Engineering Officers be warned of the difference between the above models and the importance of proceeding very cautiously in rating V-1710 engine over those war emergency ratings recommended by the manufacturer, which is particularly important in areas where high carburetor air temperatures may be encountered. If piston burning occurs at any particular station it is recommended that the engines be immediately derated 5" Hg. until it is ascertained whether the burning was due to a local condition in a particular engine such as might be caused by a broken porcelain in a spark plug or whether it is due to a poor grade of fuel which might result in an epidemic of failures on all engines.

5. We know we can depend on your cooperation in clarifying the above conditions to your operating personnel. We are advising all of our Servicemen of the difficulties which might be encountered and the proper remedies.

Yours very truly

ALLISON DIVISION
General Motors Corporation

R. M. Hazen,
Chief Engineer

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