

REMOVING DUSTS FROM BRAKE ASSEMBLIES DURING VEHICLE SERVICING— ALTERNATIVE CLEANING METHODS*

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PRELIMINARY CONSIDERATIONS

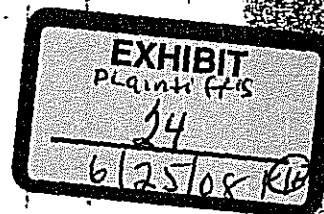
WHATEVER the criticisms may be from an occupational health point of view, few would deny that the operation of removing brake dusts with an air line is efficient in that the total time to perform the task is extremely short. The time required to perform an operation is of vital importance in industry and any process changes will always be judged relative to the time scale. In addition, the effort required from an operative in using the method should be minimal and it is easy to see that the chances of developing a technique of cleaning which will reduce dust emissions but at the same time require no more time and effort are extremely slim. Quite clearly, we must concede from the very beginning that some increase in time and effort involved is inevitable.

When viewed under normal lighting conditions, the result of applying a compressed-air line to remove brake dusts is very dramatic. Unfortunately, mere dramatization alone is not adequate to describe the emission of dust from a process; more objective methods are needed. The conventional method of evaluating an environmental condition is the measurement of the appropriate parameter (in this case—fibre counts), referring the results to hygiene standards. In experimental work to evaluate dust-control methods, simpler, "relative" techniques of measurement have considerable advantages and part of this work is concerned with applying a fairly simple method to define certain environmental conditions which prevail when brake dusts are removed by blowing out with a compressed-air line and comparing these with the conditions obtained when a dust control technique is applied. Because the method is a relative one, care to prevent errors from extraneous sources of variation is important. These sources of error are discussed later.

METHODS USED TO EXAMINE ENVIRONMENTAL CONDITIONS

When dusts are released in relatively small quantities it is often impossible to see the clouds under normal lighting conditions. They can be made visible using the Tyndall Beam effect and this has been employed extensively during the experimental work.

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Mass concentrations of airborne brake dusts were determined at two positions by sampling through tared membrane filters. In the first position, a static sampler was placed close to the sources of dust emission. Generally, this sampling position was chosen to be in the area where the results of Tyndall Beam examinations had indicated that the highest dust concentrations were likely to be obtained. Secondly, a personal air sampling device was worn by the operative in such a manner that the sampling head was attached to the wearer's lapel, as near as practicable to the breathing zone.

Samples for particle counting were taken, again in the operative's breathing zone, using a Konimeter, and membrane filter samples were also taken for subsequent fibre counts by microscopy, using the method described by ADDINGLEY (1966). Possible weighing errors due to static charges on membrane filters were prevented by weighing in a field of ionising radiation, as described by HIGGINS and DEWELL.

The results of fibre counts showed that the numbers of fibres present in the high total dust concentrations obtained when an air line was used were of a low order of magnitude and hence the total dust concentration was used as a relative method to describe the dustiness of the environment.

The location selected for the experiments was in a workshop area, behind a glazed partition, and well away from access doors, so that comparisons of cleaning methods were not affected by variations in local air movement. Smoke tests were carried out at each sample period to confirm this point.

CONDITIONS OBTAINED WHEN A COMPRESSED AIR LINE WAS USED TO REMOVE BRAKE DUSTS

A commercial vehicle brake assembly, after removal of the brake drum preparatory to cleaning, is shown in Fig. 1. In this particular case, the hub had also been removed for bearing replacement which facilitated cleaning operations. It should be noted that this is not always so and for the majority of our tests the inconvenience of the hub being present had to be contended with.

A series of Konimeter samples were taken during typical operations and also after the process had ceased. The counts for these samples are summarized in Table 1.

TABLE 1. RESULTS OF KONIMETER SAMPLES DURING BLOW-OFF

Sample	Number of brake dust particles/5 cm ³
Taken at beginning of operation	5000
Taken approx. 20 sec later	4500
Taken approx. 60 sec later	4000
Taken approx. 30 sec later	1800
Taken approx. 30 sec later	580

It is seen that there is a progressive fall in count as the local dust cloud disperses. The first three figures are approximate only, the numbers of particles collected being too high for accurate counting.

A fixed sampling period of some 5 min was chosen for the determination of mass concentrations—this being longer than required for the blowing operation but sufficient to cover that required for the alternative cleaning methods. The dust collected by the static sampler close to the brake assembly gave an equivalent concentration of 114 mg/m^3 and that for the personal air sampler 42 mg/m^3 . It is probable that many of the particles included were larger than respirable size. The few asbestos fibres counted on membrane filter samples gave a concentration of the order 3–5 fibres/ cm^3 .

ALTERNATIVE CLEANING METHODS

Initial approaches were to try the use of fixed and hand-held extractors to collect the dust particles removed by hand-brushing with a small paint brush. Fixed extractors, although reasonably efficient, were rejected because of restrictions which these placed upon the work by confining it to one area. Both operatives and supervision were unhappy about being confined to one work area—preferring to retain flexibility and carry out the work as they had previously done, wherever the vehicle happened to be. Portable extraction equipment was clearly required and after some preliminary enquiries, a BVC industrial vacuum cleaner was selected for use in experimental work. It is of fairly conventional type, powered by a $\frac{3}{4}$ h.p. motor and supplied with disposable paper bags in addition to the normal cloth bag. The paper bags are fitted in a manner which allows them to be sealed fairly easily before removal. To trap any particulates which might pass through the paper and cloth bags, an external, multi-layer filter was provided for fitting to the air outlet end of the cleaner. Preliminary experiments established that some brake dust particles were passing the paper and cloth bags but these were trapped by the externally fitted filter. Sampling at the exit side of the filter established that no particles passed the filter.

CONDITIONS OBTAINED USING THE VACUUM CLEANER AS A SOURCE OF EXTRACTION

The first technique tried was to use the nozzle of the cleaner, hand-held as a source of local extraction whilst the dust deposits were disturbed with a small paint brush held in the other hand. The Tyndall Beam showed that some dust was escaping into the environment. Objective measurements are summarized in Table 2.

TABLE 2. RESULTS OF KONIMETER SAMPLES DURING BRUSHING AND WITH LOCAL EXTRACTION

Sample	Number of brake dust particles/ 5 cm^3
Taken at start of process	1070
Taken about 1 min later	404
Taken about 2 min later	426
Taken at end of process	446

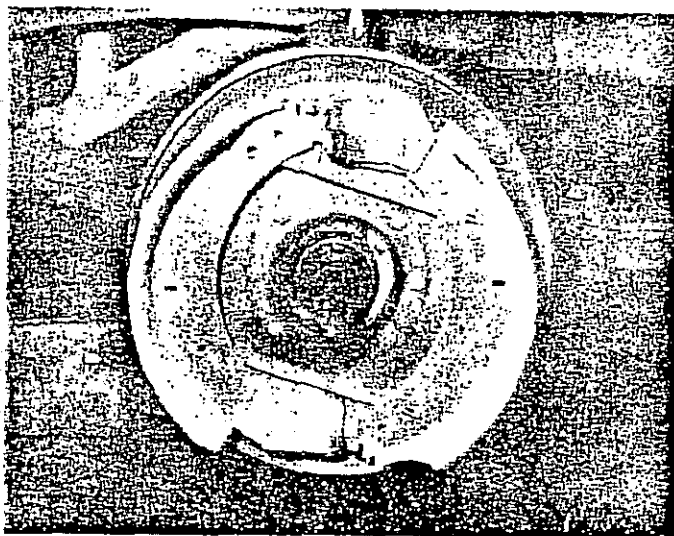


FIG. 1. Brake assembly before cleaning.

(facing p. 34)

The fixed sampler in the area of the highest concentration gave a dust concentration of 21 mg/m^3 and the personal sampler, 2.7 mg/m^3 .

An improvement in controlling the release of dust had been obtained but was not considered completely satisfactory and an alternative approach was sought.

CONDITIONS OBTAINED USING A MODIFIED TECHNIQUE

After some preliminary experiments, the following general technique was devised. Firstly, the loose deposits of dusts inside the brake drum and on readily accessible surfaces of brake shoes and the brake assembly were removed, using the smallest brush supplied with the cleaner—the equipment being used as a vacuum cleaner. A much narrower, tubular brush, made from available materials was then used to remove deposits from less accessible surfaces. Finally, a rag, soaked in water and wrung fairly dry, was used to remove adherent deposits. No visible emissions of dust were observed but a few particles were detected by the objective methods, as shown in Table 3.

TABLE 3. RESULTS OF KONIMETER SAMPLES DURING MODIFIED TECHNIQUE

Sample	Number of brake dust particles/5 cm ²
Brushing with standard brush	16-25
Brushing with tubular brush	20-25
Rag wiping	1-5

No fibres were detected and the mass concentrations involved were too low to determine.

CONCLUSIONS

The objective measurements made seem to confirm that vacuum cleaning provides a useful contribution towards obtaining satisfactory dust control when brake assemblies are cleaned. The design of the particular cleaner chosen prevents the discharge of particles back into the environment and the collection in a paper bag enables suitable disposal methods to be adopted. This work was completed in the early part of 1968 and subsequently the method described was recommended for use until such time as the results of studies being carried out elsewhere in the Motor Industry were known and detailed requirements subsequently formulated.

Acknowledgements—The assistance of Mr D. Smith of the Industrial Hygiene Department and Mr Young, Works Engineers, is gratefully acknowledged.

REFERENCES

- ADDINGLEY, C. G. (1966), *Ann. occup. Hyg.* 9, 73.
HIGGINS, R. I. and DEWELL, P. in *Instruction Leaflet 3107/A1*, C. F. Casella.

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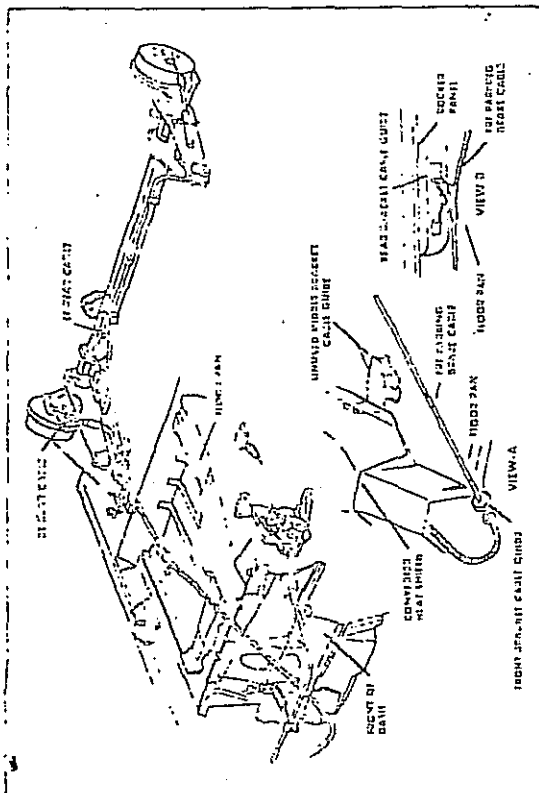


Figure 1

With the smaller vehicle, it is too difficult to provide the one-half inch-to-500 pound ratio. To maintain adequate braking power, the trend with the downsized cars is to use harder-working brake lining (friction) material.

Increasing the frictional properties of the lining material is not especially difficult, but it is tough to give a higher degree of friction along with satisfactory service life and balanced braking.

The types of brake lining material that appear to be increasing in popularity for smaller cars are metallics and modified epoxy resins. This is not to say the conventional asbestos-type lining material is no longer being used with success, but

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it does mean that you as a service technician can look forward to seeing less and less of asbestos-based brake lining material.

In addition to losing ground to the more exotic friction materials on the basis of braking performance, asbestos is taking it on the chin from the ecology-minded members of our society, due to strong evidence that asbestos fibers can be harmful to your health.

Do yourself a favor, don't wire brush dirty linings, blast them clean with compressed air, etc., and release asbestos fibers into the air.

There are several excellent pieces of equipment available to enable you to thoroughly clean brake assemblies without polluting the air. Look into them.

Service tip: Use only high-quality lining material. Don't shy away from linings that control or eliminate the use of asbestos. Work clean.

Cable routing: The "X" car front parking brake cable routing bypasses the middle underbody bracket cable guide that is located adjacent to the centrally converter (Fig. 1). This routing places the cable on a direct-line basis between the front underbody floor pan bracket guide to the rear underbody floor pan bracket guide, located on the right side.

The original design provided the bypassed middle bracket with a dual function, relative to the cable routing and the converter's upper shield attachment. Due to a subsequent routing change, the middle bracket now serves only as an underbody attaching point for the shield.

Service tip: The cable routing as shown in Figure 1 is correct. Do not reroute cable to force it through the middle bracket.

A new brake master cylinder assembly

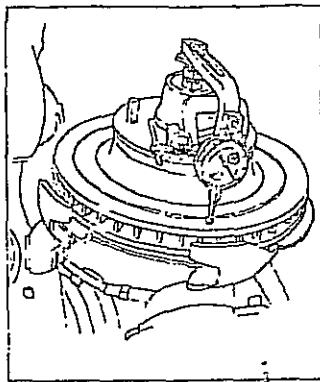


Figure 2

has been released for "X" car application. This new assembly uses aluminum proportioning valves instead of the steel proportioning valves that had been used since the start of "X" car production.

The following information helps determine aluminum and steel valves:

- The steel valve is silver in color. It comes in two versions:
 - 1) Part Number 18005689, which is 10 mm., and
 - 2) Part Number 18005690, which is 13 mm.

Service tip: The silver-color proportioning valve, Part Number 18005689-90, should be used when correcting a "clunk" condition, or for normal service replacement.

- The aluminum valve is gold in color. It comes in two versions:
 - 1) Part Number 18005626, which is 10 mm., and
 - 2) Part Number 18005627, which is 13 mm.

Service tip: Use the gold-colored valve, Part Number 18005626-27, for normal service replacement items for aluminum late-production, second-design proportioners.

NOTE: Production on these valves started late August, 1979.

CAUTION: In no instances should replacements be mixed — aluminum

where: runoff is 0.01 mm total indicator dividing (TIR).

Rotor thickness should be measured with an accurate micrometer at four or more places (Fig. 3).

Service tip: Minimum rotor thickness, revised specification, is 21.08 mm. Discard rotor when thickness measurement is 20.70 mm or less.

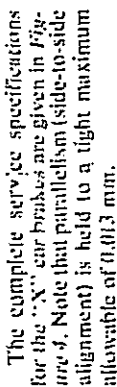


Figure 4

The rear brake drums that are used on the "X" cars were changed from an original design (non-finned) to a finned design.

Should it become necessary to replace a rear brake drum on an "X" car, use only the later-design, finned type drum.

Part Number information is as follows:

First name	Part number
Rear Brake Drum (finned)	25504467
Rear Brake Drum (non-finned)	12506649

Service tip: Do not intermix finned and non-finned brake drums on any one car.

Don't sweat "X" car brakes. But do keep up-to-date on the latest service information, which we will bring to you as it develops.

BRAKE & FRONT END

Doc 3 (maki)	9 74 1231 m
Doc 4 (maki)	832 177 14 m
Doc 5 (maki)	832 171 13 m
Doc 6 (maki)	831 161 m
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