

The Engineering Experiment Station was established in 1921 by action of the Board of Visitors of the Virginia Polytechnic Institute, to stimulate and advance engineering education and to investigate problems of special importance to the professional engineers and to the manufacturing, mining, transportation and other industrial interests of the State and the Nation. The creation of a distinct research organization within the School of Engineering has resulted in many benefits both to the institution and to the industrial life of the state. The chief benefit, as well as the primary aim, is the solution of technical problems of industry and the extension of knowledge; but of almost equal importance to the college as an educational institution is the stimulation which it gives faculty and students through the contact and study of actual, live problems from industry. The young engineering graduates are made of more immediate value to industry through having been brought by their teachers into some understanding of the current problems of industry. Of equal value is the number of research fellows who are each year given post graduate training and research experience, thus fitting them for positions in industrial research organizations. The Station will be glad to receive suggestions from industries regarding research and investigation and, where possible, will cooperate with individuals and organizations in conducting such work. When research is undertaken for the private benefit of an industry, the industry will be expected to finance the work. Studies made at public expense will be published in the form of bulletins where the results are of general interest. In other cases reports are made to those concerned. Results of commercial value may be patented and the proceeds applied to the promotion of the research work of the Engineering Experiment Station, with suitable recognition as to the rights of any industries which may have assisted in financing the work. Several research fellowships for graduate students in engineering are offered by the Station. This research is confined to problems of general interest and benefit. Under suitable conditions funds may be accepted from industries for the establishment of research fellowships where the results of the investigations would be of value only to the industries concerned. It is especially suggested that smaller industries which are individually unable to finance needed research work may find it possible by group organization to finance such work at a nominal expense to each member of the group. The Station will welcome such an arrangement by which its facilities may be made of service to the smaller industries. Suggestions of research projects are always welcome.

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VIRGINIA POLYTECHNIC
INSTITUTE



The Construction and Calibration
of the V. P. I. Wind Tunnel

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VOL. XXX, No. 9

JULY, 1937

Published Once a Month by the Virginia Polytechnic Institute
Entered as second-class matter, January 29, 1908, at the post office at Blacksburg, Virginia, under the act of July 16, 1894.

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ENGINEERING EXPERIMENT STATION SERIES
Bulletin No. 29

FOREWORD

So many requests have been received for information on the construction and capacity of the V. P. I. wind tunnel that it has been found desirable to present that information in bulletin form. This bulletin is presented in the hope that it may serve a number of purposes. It will give information on the tunnel for the benefit of other institutions which may be planning on the construction of one of similar characteristics. Moreover, the bulletin will advise engineers and industries of the wind tunnel facilities which are available at V. P. I. for research on their aerodynamic problems. For this reason, particularly, the bulletin contains the results of tests made upon standard geometric forms and the turbulence is shown in Table II in comparison with the tunnels of other well-known aerodynamic laboratories.

The attention of engineers and industrial executives is called to the fact that the wind tunnel may be used not only for studies relative to airplanes and airplane parts, but also for the studies of the wind resistance of models of automobiles and locomotives, and for studies of wind forces on buildings and structural elements, with suitable correction factors for the scale of the model tested.

E. B. NORRIS, *Director*
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The Construction and Calibration of the V. P. I. Wind Tunnel

INTRODUCTION

The science of aerodynamics has been rapidly developed since the first successful flight by a heavier-than-air machine. Experiments to determine air forces on various types and shapes of bodies are recorded dating back several centuries; but the advent of the airplane made a more extensive and exact study necessary. Modern air travel by means of both the lighter-than air and the heavier-than-air craft is the result of a great deal of painstaking investigation and experiments rewarded with an occasional success after a long series of failures.

Aerodynamic research is conducted in most all of the countries of the world at the present time. The laboratories in which these investigations are conducted are usually government-owned, although some of the important ones are operated by universities. The largest and best equipped of these laboratories is that of the National Advisory Committee for Aeronautics at Langley Field, Hampton, Virginia. Well known laboratories abroad are that at Göttingen in Germany, that of the National Physical Laboratory in England, and the Eiffel Laboratory in France.

Tests and investigations in the field of aerodynamics in all of these laboratories are carried out in wind tunnels; a wind tunnel being an apparatus for producing a stream of air which moves relative to the stationary object on which the resulting forces can be measured. If it is desired to determine the characteristics of a wing section or airfoil, the test in most tunnels must be conducted on a model airfoil very much smaller than the full-size wing. This is necessary because few wind tunnels are large enough to accommodate a full size wing. The results of such tests on models, while they may be accurate for the model, are not true for the full-scale wing unless several corrections are made. These corrections are not altogether satisfactory and experiments are under way to determine more exactly how they should be made. The N.A.C.A. variable-density tunnel was