ESDU 70015
Issued September 1970
With Amendments A and B
October 1972
Supersedes Aero W.00.01.02

Fluid forces and moments on flat plates

Endorsed by
The Royal Aeronautical Society
The Institution of Chemical Engineers
The Institution of Structural Engineers
The Institution of Mechanical Engineers

ESDU DATA ITEMS

Data Items provide validated information in engineering design and analysis for use by, or under the supervision of, professionally qualified engineers. The data are founded on an evaluation of all the relevant information, both published and unpublished, and are invariably supported by original work of ESDU staff engineers or consultants. The whole process is subject to independent review for which crucial support is provided by industrial companies, government research laboratories, universities and others from around the world through the participation of some of their leading experts on ESDU Technical Committees. This process ensures that the results of much valuable work (theoretical, experimental and operational), which may not be widely available or in a readily usable form, can be communicated concisely and accurately to the engineering community.

We are constantly striving to develop new work and review data already issued. Any comments arising out of your use of our data, or any suggestions for new topics or information that might lead to improvements, will help us to provide a better service.

THE PREPARATION OF THIS DATA ITEM

The work on this particular Data Item which supersedes and extends Data Sheet Aero W.00.01.02, was monitored and guided by the following Working Party:

Mr J. Armitt	— Central Electricity Research Laboratories
Dr L.F. Crabtree	— Royal Aircraft Establishment
Mr R.W.F. Gould	— National Physical Laboratory

on behalf of the Fluid Mechanics Steering Group which has the following constitution:

Chairman	
Mr W.F. Wiles	— Rolls Royce Ltd, Derby
Members	
Mr E.C. Firman	— Central Electricity Research Laboratories
Mr B.H. Fisher	— Consulting Structural Engineer
Dr G. Hobson	— English Electricity – AEI Turbine Generators Ltd
Mr T.V. Lawson	— University of Bristol
Mr C. Scruton	— National Physical Laboratory.

The Steering Group has benefitted from the participation of members from several engineering disciplines. In particular, Mr B.H. Fisher has been appointed to represent the interests of structural engineering as the nominee of the Institution of Structural Engineers and Mr E.C. Firman has been appointed to represent the interests of mechanical engineering as the nominee of the Institution of Mechanical Engineers.

The Item was accepted for inclusion in the Aerodynamics Sub-series by the Aerodynamics Committee which first met in 1942 and now has the following membership:

Chairman	
Prof. G.M. Lilley	— University of Southampton
Vice-Chairman	
Prof. D.W. Holder	— University of Oxford
Mr W.F. Wiles	— Rolls Royce Ltd, Derby

(*Continued on inside back cover*)

FLUID FORCES AND MOMENTS ON FLAT PLATES

CONTENTS

FLUID FORCES AND MOMENTS ON FLAT PLATES

1. NOTATION AND UNITS

Two coherent systems of units are given below. See end of notation for footnotes.

		SI	*British*
a	distance between two plates in series	m	ft
b	span of plate	m	ft
C_N	normal force coefficient in uniform flow, $N/½\rho V_\infty^2 S$		
c	chord of plate	m	ft
d_i, d_o	inner, outer diameter of circular plate with hole (see Figure 6)	m	ft
h	distance from datum in shear flow (Section 3.6)	m	ft
k_1, k_2	correction factors for effect of turbulence (Section 3.1)		
L_x	longitudinal integral scale of turbulence* in free stream	m	ft
N	normal force on plate	†N	lbf
n	constant defining velocity profile in shear flow (Section 3.6)		
Re	Reynolds number, $V_\infty c/\nu$		
S	area of plate	m^2	ft^2
S_f	open area of perforated plate	m^2	ft^2
s	spacing between plates in series (see Figure 4)	m	ft
V	velocity	m/s	ft/s
V_∞	average free-stream velocity in uniform flow	m/s	ft/s
V_{eff}	effective average velocity in shear flow (Section 3.6)	m/s	ft/s
$\sqrt{\overline{u^2}}$	root mean square value of longitudinal component of velocity fluctuations* due to turbulence in free stream	m/s	ft/s
x_{cp}	distance along centre line of centre of pressure behind leading edge of plate	m	ft

Issued September 1970
With Amendments A and B, October 1972 – 18 pages