

NOMENCLATURE (SAMPLE)

A	area, m ²
c_p	specific heat at constant pressure, J/kg K
$\bar{c}_p$	averaged specific heat within the range of $(T_w - T_b)$; $\left(\frac{H_w - H_b}{T_w - T_b} \right)$, J/kg K
D	inside diameter, m
D_{hy}	hydraulic diameter, m; $\left(\frac{4 A_{fl}}{P_{wetted}} \right)$
f	friction factor; $\left(\frac{\frac{\sigma_w}{G^2}}{8 \rho} \right)$
f_d	drag coefficient
G	mass flux, kg/m ² s; $\left(\frac{m}{A_{fl}} \right)$
g	gravitational acceleration, m/s ²
H	specific enthalpy, J/kg
h	heat transfer coefficient, W/m ² K
HL	heat loss, W
I	current, A
k	thermal conductivity, W/m K
L	length, m
m	mass-flow rate, kg/s; (ρV)

p	pressure, Pa
POW	power, W
Q	heat-transfer rate, W
q	heat flux, W/m ² ; $\left(\frac{Q}{A_h} \right)$
q_v	volumetric heat flux, W/m ³ ; $\left(\frac{Q}{V_h} \right)$
R	molar gas constant, 8.31451 J/mol K
R_a	arithmetic average surface roughness, μm
R_{el}	electrical resistance, Ohm
r	radial coordinate or radius, m; regression coefficient
T	temperature, K
t	temperature, $^{\circ}\text{C}$
U	voltage, V
u	axial velocity, m/s
V	volume, m ³ or volumetric flow rate, m ³ /s
V_m	molar volume, m ³ /mol
v	radial velocity, m/s
x, y, z	coordinates, m

Greek Letters

α	thermal diffusivity, m ² /s; $\left(\frac{k}{c_p \rho} \right)$
β	volumetric thermal expansion coefficient, 1/K
Δ	difference

Δ_{HB}	error in heat balance, %
δ	thickness, mm
μ	dynamic viscosity, Pa s
π	reduced pressure; $\left(\frac{p}{p_{cr}} \right)$
P	perimeter, m
ρ	density, kg/m ³
ρ_{el}	electrical resistivity, Ohm·m
σ	dispersion
σ_w	viscous stress, Pa
ν	kinematic viscosity, m ² /s
ζ	friction coefficient

Non-Dimensional Numbers

Ga	Galileo number; $\left(\frac{g D^3}{\nu^2} \right)$
Gr	Grashof number; $\left(\frac{g \beta \Delta T D^3}{\nu^2} \right)$
Gr_q	modified Grashof number; $\left(\frac{g \beta q_w D^4}{k \nu^2} \right)$
Nu	Nusselt number; $\left(\frac{h D}{k} \right)$
Pr	Prandtl number; $\left(\frac{\mu c_p}{k} \right) = \left(\frac{\nu}{\alpha} \right)$

$\overline{\text{Pr}}$ averaged Prandtl number within the range of $(T_w - T_b)$; $\left(\frac{\mu \bar{c}_p}{k} \right)$

Re Reynolds number; $\left(\frac{G D}{\mu} \right)$

Ra Raleigh number; **(Gr Pr)**

St Stanton number; $\left(\frac{\text{Nu}}{\text{Re Pr}} \right)$

Symbols with an overline at the top denote average or mean values (e.g., $\overline{\text{Nu}}$ denotes average (mean) Nusselt number).

Subscripts or Superscripts

ac acceleration

amb ambient

ave average

b bulk

cal calculated

cr critical

cr sect cross section

dht deteriorated heat transfer

el electrical

ext external

f fluid

fl flow

fm flowmeter

fr friction

g	gravitational
h	heated
HB	Heat Balance
hor	horizontal
hy	hydraulic
in	inlet
int	internal
iso	isothermal
ℓ	liquid or local
m	molar
max	maximum
meas	measured
min	minimum
nom	nominal or normal
0	constant properties, scale, reference, characteristic, initial, or axial value
out	outlet or outside
OD	outside diameter
p	pressure
pc	pseudocritical
T	value of turbulent flow
TS	test section
th	threshold value
tot	total

v volumetric

vert vertical

w wall

Acronyms and abbreviations widely used in text and list of references

AC Alternating Current

A/D Analog-to-Digital (conversion)

A/I Analog Input

AECL Atomic Energy of Canada Limited (Canada)

AERE Atomic Energy Research Establishment (UK)

AGR Advanced Gas-cooled Reactor

AIAA American Institute of Aeronautics and Astronautics

AIChE American Institute of Chemical Engineers

ANS American Nuclear Society

ASME American Society of Mechanical Engineers

ASHRAE American Society of Heating, Refrigerating and Air-conditioning Engineers

AWG American Wire Gauge

BWR Boiling Water Reactor

CANDU CANada Deuterium Uranium (nuclear reactor)

CFD Computational Fluid Dynamics

CHF Critical Heat Flux

CRL Chalk River Laboratories, AECL (Canada)

DAS Data Acquisition System

DC Direct Current

DOE	Department Of Energy (USA)
DP	Differential Pressure
emf	electromagnetic force
ENS	European Nuclear Society
EU	European Union
EXT	EXTernal
FA	Fuel Assembly
FBR	Fast Breeder Reactor
FM	FlowMeter
F/M	Ferritic-Martensitic (steel)
FR	Fuel Rod
f.s.	full scale
FT	Flow Transducer
GIF	Generation IV International Forum
HMT	Heat Mass Transfer
HT	Heat Transfer
HTC	Heat Transfer Coefficient
HTD	Heat Transfer Division
HTR	High Temperature Reactor
HVAC & R	Heating Ventilating Air-Conditioning and Refrigerating
IAEA	International Atomic Energy Agency (Vienna, Austria)
ID	Inside Diameter
INEEL	Idaho National Engineering and Environmental Laboratory (USA)

IP	Intermediate-Pressure (turbine)
IPPE	Institute of Physics and Power Engineering (Obninsk, Russia)
JAERI	Japan Atomic Energy Research Institute
JSME	Japan Society of Mechanical Engineers
KAERI	Korea Atomic Energy Research Institute (South Korea)
KPI	Kiev Polytechnic Institute (nowadays National Technical University of Ukraine “KPI”) (Kiev, Ukraine)
KP-SKD	Channel Reactor of Supercritical Pressure (in Russian abbreviations)
LP	Low-Pressure (turbine)
LOCA	Loss Of Coolant Accident
LOECC	Loss Of Emergency Core Cooling
Ltd.	Limited
LWR	Light Water Reactor
MEI	Moscow Power Institute (Moscow, Russia) (In Russian abbreviations)
MIT	Massachusetts Institute of Technology (Cambridge, MA, USA)
MOX	Mixed Oxide (nuclear fuel)
NASA	National Aeronautics and Space Administration (USA)
NIST	National Institute of Standards and Technology (USA)
NPP	Nuclear Power Plant
OD	Outside Diameter
PC	Personal Computer
PDT	Pressure Differential Transducer
PLC	Programmable Logic Controller
ppb	parts per billion

ppm	parts per million
PT	Pressure Tube or Pressure Transducer
PWAC	Pratt & Whitney AirCraft
PWR	Pressurized Water Reactor
R	Refrigerant
RAS	Russian Academy of Sciences
RBMK	Reactor of Large Capacity Channel type (in Russian abbreviations)
RIPE	Research and Development Institute of Power Engineering (Moscow, Russia) (NIKIET in Russian abbreviations)
R&D	Research and Development
RMS	Root-Mean-Square (error or surface roughness)
RPV	Reactor Pressure Vessel
RSC	Russian Scientific Centre
RTD	Resistance Temperature Detector
SCP	SuperCritical Pressure
SCR	SuperCritical Reactor
SCW	SuperCritical Water
SCWO	SuperCritical Water Oxidation (technology)
SCWR	SuperCritical Water-cooled Reactor
SFL	Supercritical Fluid Leaching
SFR	Sodium Fast Reactor
SKD	SuperCritical Pressure (in Russian abbreviations)
SMR	Steam-Methane-Reforming (process)
SS	Stainless Steel
TC	ThermoCouple

TE	TEmperature
TECO	TEmperature of CO ₂
TS	Test Section
TsKTI	Central Boiler-Turbine Institute (St.-Petersburg, Russia) (in Russian abbreviations)
UCG	Uranium-Carbide Grit pored over with calcium (nuclear fuel)
UK	United Kingdom
U.K.A.E.A.	United Kingdom Atomic Energy Authority (UK)
UNESCO	United Nations Educational, Scientific and Cultural Organization (Paris, France)
US or USA	United States of America
VHTR	Very High-Temperature Reactor
VNIAM	All-Union Scientific-Research Institute of Atomic Machine Building (Russia) (in Russian abbreviations)
VTI	All-Union Heat Engineering Institute (Moscow, Russia) (in Russian abbreviations)
wt	weight
WWPR	Water-Water Power Reactor (“VVER” in Russian abbreviations)