

Symbols for Hydrodynamic Drives

1. **Scope**—The following system of symbols is recommended for use in technical papers and engineering reports dealing with hydrodynamic drives.

2. References

2.1 **Applicable Publication**—The following publication forms a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J641—Hydrodynamic Drives Terminology

3. **Hydrodynamic Symbols**—Where possible, the symbols consist of the first letter of the name of the quantity as given in SAE J641; for example: R for radius, A for area, a for angle, d for density. Subscripts, where needed, are also based on the standardized nomenclature; for example: R_R for radius of reactor or R_{R1} for radius of first reactor when more than one reactor is in question. Only one superscript is used for a given element; for example: in the difference between entrance and exit angles, a' is blade entrance angle and a is blade exit angle.

These symbols were selected so that when used with the standard nomenclature, they are easy to remember, are as simple as practical to write and read without danger of confusion, and require no special type to print. Several already-established engineering symbols have been retained, such as E for efficiency, H for head in m (ft), and N for rpm. Where no standardization exists at present, the most suitable letters have been chosen as symbols.

4. List of Common Symbols

A = area, net, normal to axial plane, m^2 (ft^2)

A_Q = area, gross, between shell and core normal to axial plane, m^2 (ft^2)

a = angle, blade exit, degree ($^\circ$)

a' = angle, blade entrance, degree ($^\circ$)

B = width of channel, projected width of blade, mm (in)

b = angle, relative blade exit, degree ($^\circ$)

b' = angle, relative blade entrance, degree ($^\circ$)

C = coefficient

D = diameter, m (ft)

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- d = density, kg/m³ (lb/ft³)
- E = efficiency
- F = fluid velocity in axial plane, torus flow, m/s (ft/s) (Refer to Figure 1)
- g = gravity constant, 9.806 m/s² (32.2 ft/s²)
- H = head, m (ft)
- h = thickness of blade, mm (in)
- K = capacity factor, rpm/(N·m)^{1/2} [rpm/(lb-ft)^{1/2}]
- M = mass flow, kg/s (slugs/s)
- L = moment of momentum, kg·m²/s (slugs ft²/s)
- N = speed (rev/min)
- n = speed ratio
- P = power, watts (hp)
- Q = volumetric flow rate, m³/s (ft³/s)
- R = radius, m (ft)
- S = tangential component of absolute velocity, m/s (ft/s) (Refer to Figure 1)
- T = torque, N·m (lb-ft)
- t = torque ratio
- U = linear velocity of a point on a blade, m/s (ft/s)
- V = absolute velocity, m/s (ft/s) (Refer to Figure 1)
- W = relative velocity, m/s (ft/s) (Refer to Figure 1)
- w = angular velocity, rad/s
- % = number of blades

5. Examples

5.1 Examples of Use of Symbols

Capacity Factor: $K = N/T^{1/2}$

Torque Exerted on Impeller: $T_1 = M (S_1 \times R_1 - S'_1 \times R'_1)$

$$\text{Efficiency: } E = \frac{T_T}{T_1} \times \frac{N_T}{N_1} = t \times n \quad (\text{Eq. 1})$$

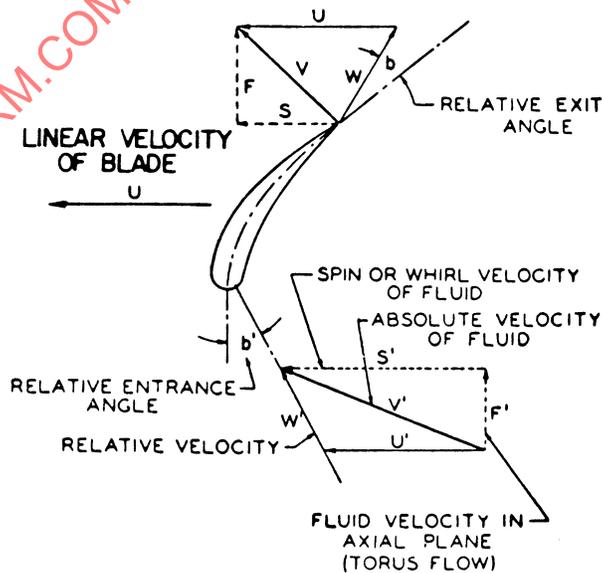


FIGURE 1—VECTOR DIAGRAM SHOWING USE OF HYDRODYNAMIC DRIVE SYMBOLS

TABLE 1—SUMMARY OF HYDRODYNAMIC DRIVE SYMBOLS

	First Impeller	Second Impeller	First Turbine	Second Turbine	First Reactor	Second Reactor
Radius, blade entrance, m (ft)	R'_{11}	R'_{12}	R'_{T1}	R'_{T2}	R'_{R1}	R'_{R2}
Radius, blade exit, m (ft)	R_{11}	R_{12}	R_{T1}	R_{T2}	R_{R1}	R_{R2}
Torque, N·m (lb-ft)	T_{11}	T_{12}	T_{T1}	T_{T2}	T_{R1}	T_{R2}
Angle, blade entrance ⁽¹⁾	a'_{11}	a'_{12}	a'_{T1}	a'_{T2}	a'_{R1}	a'_{R2}
Angle, blade exit ⁽¹⁾	a_{11}	a_{12}	a_{T1}	a_{T2}	a_{R1}	a_{R2}
Tan, blade entrance angle	$\tan a'_{11}$	$\tan a'_{12}$	$\tan a'_{T1}$	$\tan a'_{T2}$	$\tan a'_{R1}$	$\tan a'_{R2}$
Angle, relative blade entrance ⁽¹⁾	b'_{11}	b'_{12}	b'_{T1}	b'_{T2}	b'_{R1}	b'_{R2}
Cot, blade exit angle	$\cot a_{11}$	$\cot a_{12}$	$\cot a_{T1}$	$\cot a_{T2}$	$\cot a_{R1}$	$\cot a_{R2}$
Head, m (ft)	H_{11}	H_{12}	H_{T1}	H_{T2}	H_{R1}	H_{R2}
Speed, rpm	N_{11}	N_{12}	N_{T1}	N_{T2}	N_{R1}	N_{R2}
S, Entrance, m/s (ft/s)	S'_{11}	S'_{12}	S'_{T1}	S'_{T2}	S'_{R1}	S'_{R2}
V, Exit, m/s (ft/s)	V_{11}	V_{12}	V_{T1}	V_{T2}	V_{R1}	V_{R2}
U, Entrance, m/s (ft/s)	U'_{11}	U'_{12}	U'_{T1}	U'_{T2}	U'_{R1}	U'_{R2}
W, Exit, m/s (ft/s)	W_{11}	W_{12}	W_{T1}	W_{T2}	W_{R1}	W_{R2}
F, Entrance, m/s (ft/s)	F'_{11}	F'_{12}	F'_{T1}	F'_{T2}	F'_{R1}	F'_{R2}

1. degree (°)

6. **Notes**

- 6.1 **Marginal Indicia**—The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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