

**MIL-STD-1403**

**9 June 1967**

# **MILITARY STANDARD**

## **PUMP, CENTRIFUGAL: METHOD OF RATING**



**FSC 4320**

## FOREWORD

Centrifugal pumps are described by delineating various physical characteristics and by expressing a rating in terms of head and capacity. Since head and capacity in centrifugal pumps obey an inverse relationship, it is possible for a centrifugal pump to have many different head and capacity rating points within the limit of the pumps' capabilities. This standard is necessary to establish some uniform method to rate centrifugal pumps and provide guidance to that person who must select numerical values of head and capacity which appear in a centrifugal pumps' description.

This standard was developed over a five year period during which many attempts were made to produce a rating standard based on physical characteristics and performance. Continued study revealed that the great variety of types as well as sizes were too numerous to permit any one method of rating.

A different method of rating for each type of centrifugal pump such as single stage, multi-stage, double intake, self-priming, close coupled, was determined to be unworkable; therefore, it was necessary to establish major categories with a method of rating for each. Only on the basis of intended use could major groupings of centrifugal pumps be accomplished, thereby providing the minimum number of methods of rating and consequently the least complexity in the standard's use.

The rating described in this standard is restricted to the head-capacity relationship of centrifugal pumps and does not cover other variables of the performance characteristics.

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## FIGURES

Figure 1 - Typical specific-purpose pump curve

Figure 2 - Typical general-purpose pump curve

## 1. SCOPE

1.1 Scope. This standard shall be used to establish the rating of pumps described by Federal Catalog Item Name (see 3.7) as "Pump, Centrifugal".

1.2 Classification. Centrifugal pumps shall be rated by one of the following methods:

Type I method for rating specific-purpose pumps (see 3.2) based on one of the following classes:

Class A Maximum Efficiency Rating  
Class B Specified Rating

Type II method for rating general-purpose pumps (see 3.3).

## 2. REFERENCED DOCUMENTS

2.1 Nongovernmental. The specific issues in effect on the date of approval form a part of this standard to the extent stipulated herein.

### HYDRAULIC INSTITUTE

Standards of the Hydraulic Institute

(Application for copies should be addressed to the Hydraulic Institute, 122 East 42nd Street, New York, N. Y. 10017.)

### CONTRACTORS PUMP BUREAU

Contractors Pump Standards of the Contractors Pump Bureau,  
Thirteenth Revision

(Application for copies should be addressed to the Contractors Pump Bureau, Associated General Contractors of America, Inc., 20th and E Streets, Washington, D. C. 20006.)

## 3. DEFINITIONS

3.1 Explanation. Definitions given in this standard are solely for the purposes of this document and are not necessarily applicable to other documents.

3.2 Specific-purpose pump. A specific-purpose pump is one which is procured for use in a particular system or installation. Such systems impose relatively stable capacity and head conditions. The pump is selected or designed to meet the performance required by the system.

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3.3 General-purpose pump. A general-purpose pump is one which is procured with many uses contemplated rather than a permanent installation in a fixed system. This type centrifugal pump is intended for installation and reinstallation throughout its useful life and used for dewatering, liquid transfer, and similar services.

3.4 Designed operating speed. The designed operating speed of a pump supplied with a prime mover shall express the pump speed when the prime mover is operating at its maximum continuous full load operating speed. For pumps supplied less prime mover, the designed operating speed is that speed at which the pump was designed to operate.

3.5 Performance curve. A performance curve is a graphic illustration of a pump's performance showing how capacity varies with changes in total head. Performance curves usually are based on constant speed operation and also depict changes in efficiency and required brake horsepower in relation to changes in capacity.

3.6 Lowest rated head. The lowest rated head is an arbitrary figure expressing the total head when the pump is operated under the conditions described in 3.6.1 and the figure for the total head is corrected as described in 3.6.2.

3.6.1 Operating conditions.

Pump speed - designed operating speed.

Static suction life - 10 feet with suction piping as described in paragraph B-149 of the "Standards of the Hydraulic Institute" entitled Testing of Self-Priming Pumps.

Discharge pressure - minimum.

Capacity - maximum.

Atmospheric conditions - standard sea level (29.92 in. hg., 68° F.).

3.6.2 Correction. The figure for total head shall be corrected to the closest figure (higher or lower as the case may be) that is evenly divisible by five.

3.7 Federal catalogue item name. In the process of establishing the Federal Catalog System, it was necessary to select names for the various items to be catalogued. The item names are listed in the Cataloging Handbook H6-1, Part 1, titled "Alphabetic Index of Names".

3.8 Other definitions. The definitions for all other terms used in this standard shall be in compliance with the definitions given in the "Standards of the Hydraulics Institute".

#### 4. RATINGS

4.1 Type I rating (specific-purpose pump). A type I rating of a centrifugal pump shall be established by expressing the pumps performance at one point on the head versus capacity performance curve. The point selected to indicate the rating shall be determined by one of the two methods, (classes), described below.

4.1.1 Type I, Class A rating. The type I, class A method of rating shall express the capacity in gallons per minute (GPM) and the total head in feet (ft.) at the point of maximum pump efficiency when operating at its designed operating speed. The rating shall be followed by the phrase "maximum efficiency rating".

4.1.2 Example. A type I, class A rating for the specific-purpose pump whose performance curve is shown in figure 1 would be stated as follows: "The pump is rated at 90 gpm at 76 ft. total head, maximum efficiency rating".

4.1.3 Type I, Class B rating. A type I, class B rating shall express the capacity, (gpm), and total head, (ft.), as specified by the purchasing activity. The rating shall be followed by the phrase "specified rating".

4.1.4 Example. A typical type I, class B rating is stated in this manner: "The pump is rated at 400 gpm at 370 ft. total head, specified rating".

4.2 Type II rating (general-purpose pump). The type II rating of a centrifugal pump shall be established by expressing the capacity (gpm) and head (ft.) at the lowest rated head.

4.2.1 Example. A type II rating for the general-purpose pump whose performance curve is shown in figure 2 would be stated as follows: "The pump is rated at 276 gpm at 20 ft. lowest rated head".

4.3 Multiple ratings. Centrifugal pumps, which will be operated at more than one point on the performance curve, which will be operated at more than one speed, which will be operated with more than one method of stage connection, or which will be operated with some other variable, will be given a multiple rating.

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4.3.1 A multiple rating expresses the capacity (gpm) and head (ft.) according to one of the types (type I or type II) as described above for each operating condition. All segments of the multiple rating shall be determined by the same type and/or class rating method.

4.3.2 A multiple rating shall include the differentiating factor such as: Operating speed at each rating; stage connection at each rating (series or parallel); high and low pressure ratings on the same performance curve; or any other differentiating factors (e.g. specific gravity, temperature, viscosity).

#### 4.3.3 Examples of multiple ratings.

4.3.3.1 A typical multiple rating based on operating at more than one point on the performance curve would be stated as follows: "The pump is rated at 600 gpm at 1630 ft. total head, specified rating, high pressure; 1050 gpm at 1450 ft. total head, specified rating, low pressure".

4.3.3.2 A typical multiple rating based on operation at more than one speed would be stated as follows: "The pump is rated at 200 gpm at 300 ft. total head, specified rating, at 3300 rpm; 225 gpm at 350 ft. total head, specified rating, at 3600 rpm".

4.3.3.3 A typical multiple rating based on operation of a pump capable of different stage connections would be stated as follows: "The pump is rated at 900 gpm at 275 ft. total head, specified rating, parallel stages; 500 gpm at 555 ft. total head, specified rating, series stages".

## 5. NOTICES

5.1 Copies of this standard for military use may be obtained as indicated in the foreword to, or the general provisions of, the Index of Specifications and Standards. The title and identifying symbol should be stipulated when requesting copies of military standards.

5.2 Copies of specifications, standards, drawings, and publications required by supplier in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.

#### Custodians:

Army - ME  
Navy - YD

#### User activity:

Army - MU, CE  
Navy - MC

#### Preparing activity:

Army - ME

Project No. 4320-0081

#### Review activity:

Army - GL, AV  
Navy - SH, YD

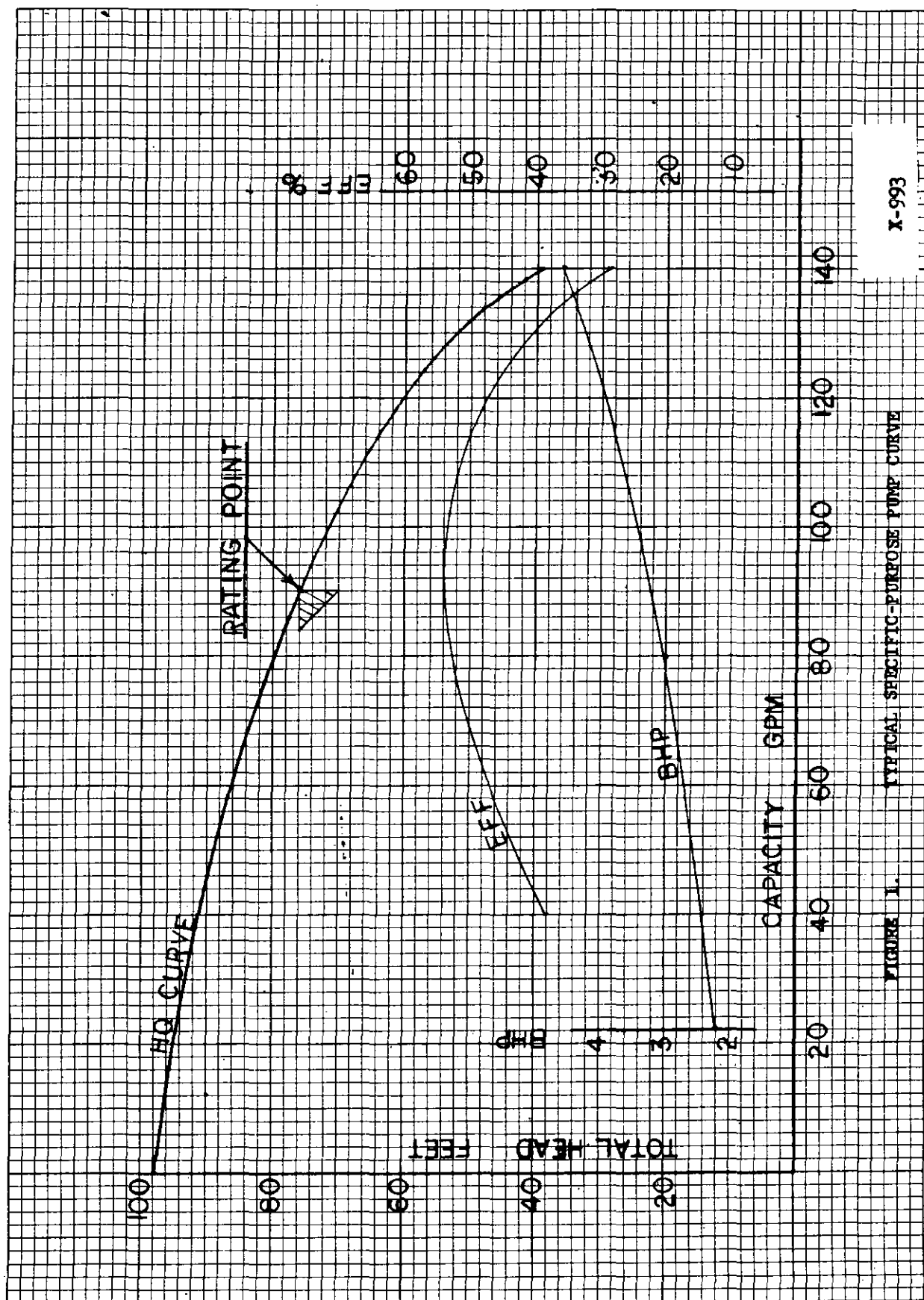
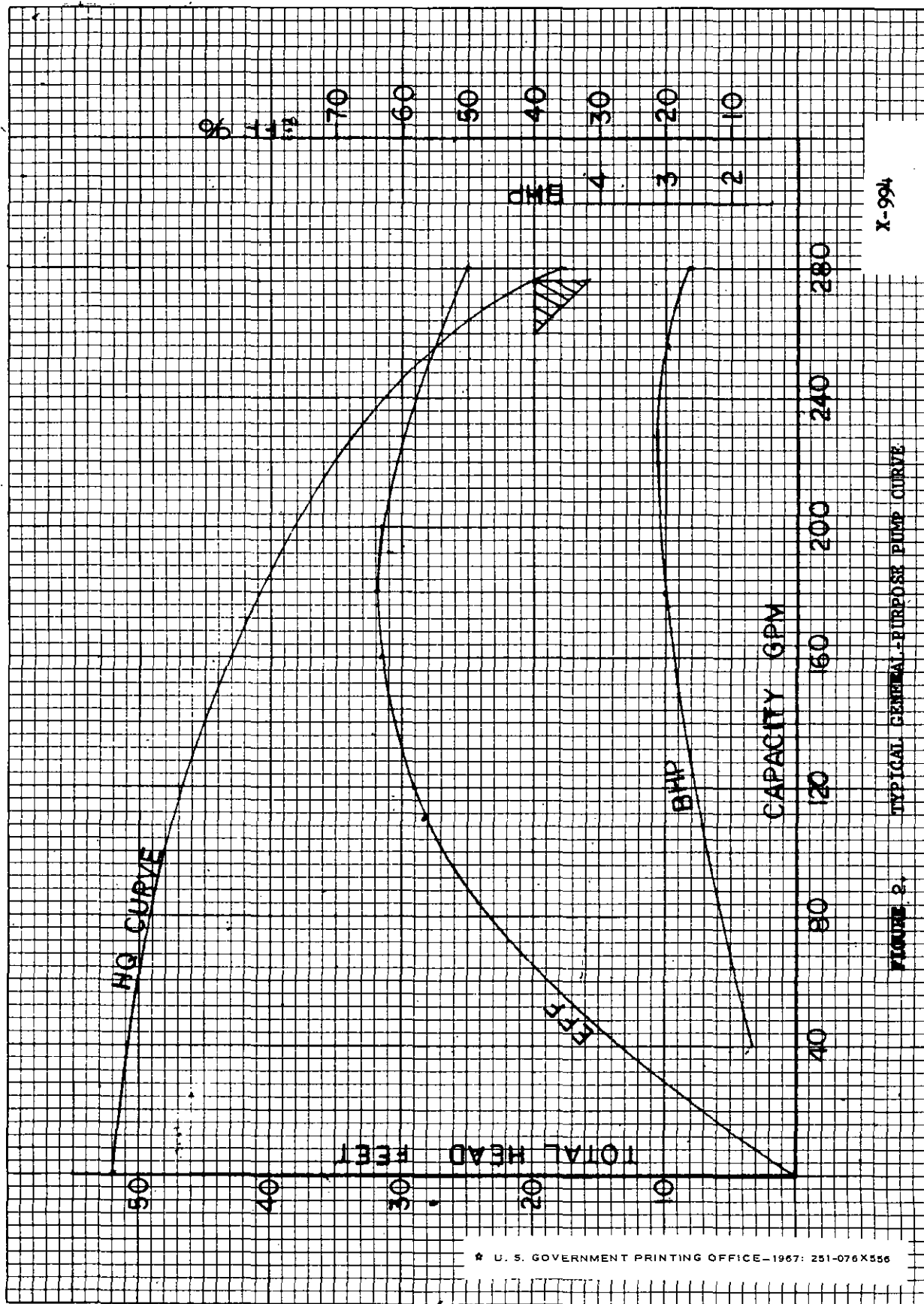


FIGURE 1. TYPICAL SPECIFIC-PURPOSE PUMP CURVE

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FIGURE 2. TYPICAL GENERAL-PURPOSE PUMP CURVE