RUHRPUMPEN

NFPA MEMBER

UL LISTED

FM APPROVED

FIRE PUMP QUICK TAKES

BULLETIN

+75 YEARS CREATING
PUMPING TECHNOLOGY
FOR LIFE

We deliver industrial fluid-handling solutions ranging from off-the-shelf pumps, through to pre-configured process packages, and engineered-to-order systems.

The Ruhrpumpen brand means “Solution”. Our experienced fluid handling team assist with commercially-centric application challenges across all areas of the world.

Safeguarding families with fire protection packages, facilitating health within pharmaceutical production, and providing clean drinking water, are just a few reasons which make Ruhrpumpen the ideal life-choice for industrial pumping equipment.

We aim to reduce our planet’s carbon footprint and waste plastic. Ecologically-biased engineers use lean and clean processes to manufacture solutions by employing parts that have a long lifetime and can eventually be recycled.

Ruhrpumpen at a Glance

- Vertical Integration
- 70 years of experience
- Sales offices in more than 35 countries
- +2,000 employees
- Manufacturing facilities in 10 countries
- Global Service Centres

Sustainable pumping solutions installed globally

PUMPING TECHNOLOGY FOR LIFE...

PUMP PERFORMANCE CURVE

a. Is a key tool to ensure the fire protection system will work correctly in an emergency.

b. When evaluating a Fire system, the curve helps you:

- i. Verify that the pump meets the building's water flow and pressure needs. Maximum system demand, including hose streams when applicable, shall be within 140% of pump rated (listed) capacity.
- ii. Ensure compliance with NFPA 20 standards.
- iii. Avoid over- or under-sizing the pump, preventing failures or unnecessary costs.
- iv. Manufacturer's certified pump curve shall be used as the reference for compliance at the time of site acceptance test.

c. In short, it's like previewing the pump's performance before purchasing.

d. How to read a Fire Pump Curve

- i. Flow (X-axis): Shows how much water the pump delivers, in GPM or L/s.
- ii. Head (Y-axis): Shows the head the pump can produce, in ft or meters.
- iii. Performance Curve: Line showing how pressure drops as flow increases.
- iv. Rated point: The pump's listed capacity (e.g., 1000 GPM @ 100 ft
- v. NFPA 20 Range: Acceptable range from 90% to 140% of rated flow.
- vi. Additional Curves: May include power (HP), efficiency, and NPSH required.

PUMP CHARACTERISTICS CURVES

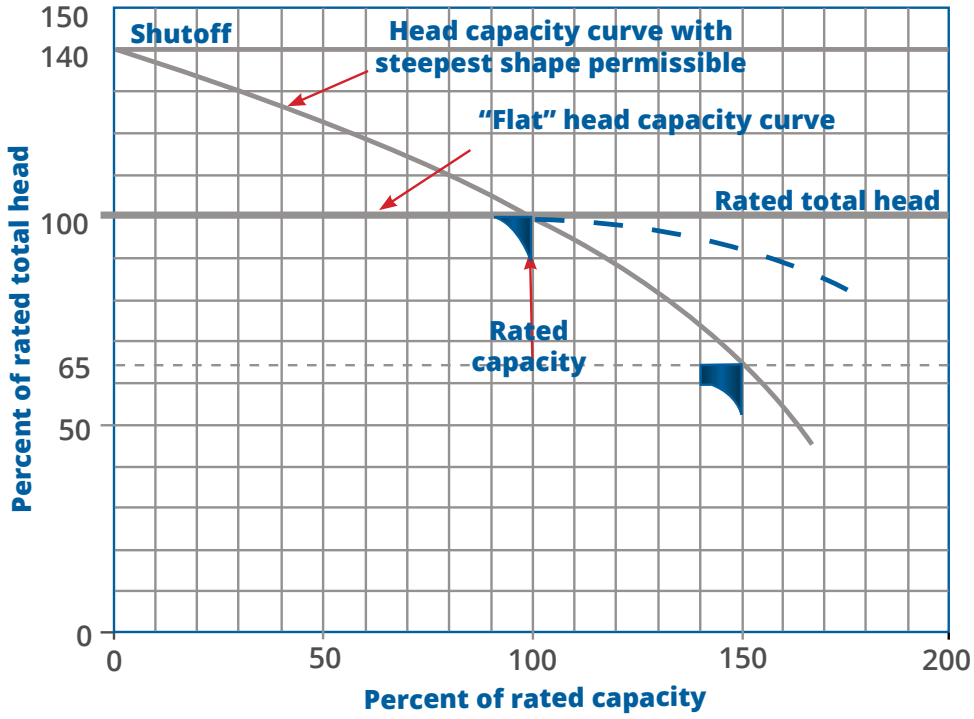

Figure A.6.2

NFPA

The **NFPA**, for its acronym in English, **"NATIONAL FIRE PROTECTION ASSOCIATION"** is an American non-profit organization that, among other functions, oversees creating and maintaining standards and requirements for the construction and installation of fire equipment. (sprinklers, hoses, pumps, hydrants, etc.)

Founded in 1896 devoted to eliminating death, injury, property and economics loss due to fire, electrical and related

NFPA 20 Refers to the installation of stationary pumps for fire protection:

- 1. Pipe & component sizing.
- 2. Testing requirements of equipment.
- 3. Requirements for drivers, controllers and accessories.
- 4. Field acceptance testing.

PUMPING TECHNOLOGY FOR LIFE...

Is the NFPA a certification body?

NO, NFPA is not a certification body. It is an organization that develops fire safety standards and codes, but it does not certify products or companies

Who certifies that something complies with NFPA?

That's done by independent testing and certification organizations that are authorized to evaluate products according to NFPA standards. The most well-known are:

a. UL:

- i. The Underwriters Laboratories lists and approves equipment for fire pump service.
- ii. Witnesses testing of fire pumps for specific flow rates
- iii. UL-448 Centrifugal Stationary Pumps for Fire Protection Services:
    1. Specification for fire pumps
    2. Specification pump design and materials
    3. Specification for pump testing

b. FM:

- i. Factory Mutual began in 1935 as Manufactures Mutual Fire Insurance Company.
- ii. Insurer in addition to being a testing and approval agency for all types of fire pumps and systems
- iii. Approves the installation & design of fire pump and fire protection systems. Some applicable listing standards for FM insured installations:

1. FM 1311 – Split Case Fire Pumps
2. FM 1312 – Vertical Turbine Fire Pumps
3. FM 1313 – Positive Displacement Fire Pumps
4. FM1319 – End Suction Fire Pumps
5. FM 1372 – Vertical In-line Fire Pumps

PACKAGE SCOPE (APPENDIX D FOR VTP AND APPENDIX C FOR HS)

	Split Case / End Suction / In Line Centrifugal Pump		Vertical Shaft Turbine Centrifugal Pump	
	Electric	Diesel	Electric	Diesel
Fire pump*	X	X	X	X
Electric Motor*	X		X	
Diesel Engine*		X		X
Controller*	X	X	X	X
Batteries		X		X
Cooling water and fuel lines		X		X
Exhaust piping and muffler		X		X
Fuel tank		X		X
Flexible coupling or drive shaft	X	X	X	X
Suction and discharge pressure gauges*	X	X	X	X
Pressure relief valve*	X	X	X	X
Automatic air release valve*	X	X	X	X
Circulation relief valve*	X	X	X	X
Substantial bedplate for pump and driver	X	X	X	X
IOM in local language	X	X	X	X

*** Retrieved from FM Approvals Appendix D and C.**

*** Products marked with * must be certified by FM.**

MAIN RELIEF VALVE (WHEN IS IT APPLICABLE?)

Per NFPA-20, 2019;4.20.1.2, 4.20.1.3, there are only two scenarios in which a Main relief valve shall be installed:

- Where a diesel engine fire pump is installed and a total of 121 percent of the net rated shutoff (churn) pressure plus the maximum static suction pressure, adjusted for elevation, exceeds the pressure rating of the system components, a main relief valve shall be installed.
- Where an electric variable speed pump or a diesel pressure-limiting driver is installed and the maximum total discharge head, adjusted for elevation, with the pump operating at shutoff and rated speed exceeds the pressure rating of the system components, a main relief valve shall be installed.

KEY CONSIDERATIONS BEFORE REPLACING ANY COMPONENT ON AN EXISTING INSTALLATION

a. Type of component

- i. Replacing certified components in a fire protections system can range from relatively simple and low cost to highly expensive and technically complex, depending on the part involved. Minor replacement may only require a like-for-like certified component, while major changes-such as a fire controller- could lead to loss certification. Require retesting or re-approval and significantly increase costs and project delays.

b. Risks

- i. Using non-certified or incompatible parts can compromise the entire system's safety and void manufacturer warranties.

c. Recommendations

- i. Avoid modifying certified systems unless necessary.
- ii. Always use UL/FM certified components that are compatible with the existing system.
- iii. Notify and coordinate with the Authority having jurisdiction, such as the local fire marshal or building code official, to ensure that the modifications are reviewed and accepted.
- iv. Consult Ruhrpumpen before making any changes or component replacement.

Factory Performance test tolerances used for UL listed Fire Pumps (Level 1U):

Test Parameter	Guarantee requirement	Grade	Grade 1			Grade 2		Grade 3
		ΔtQ	10%			16%		18%
		ΔtH	6%			10%		14%
		Symbol	Acceptance grade					
			1B	1E	1U	2B	2U	3B
Rate of flow	Mandatory	tQ (%)	± 5%	± 5%	0% to +10%	± 8	0% to +16%	± 9%
Total head	Mandatory	tH (%)	± 3%	± 3%	0% to +6%	± 5	0% to +10%	± 7%
Power[a]	Optional (either/or)	tp (%)	+ 4%	+ 4%	+10%	+ 8	+16%	+9%
Efficiency[a]		t (%)	- 3%	- 0%	- 0%	- 5	- 5%	- 7%

* The power and efficiency tolerances are not the result of an exact calculation using the maximum values of a related column. They are instead refledting real life expetience. For grade 1E and 1U, no negative tolerance on efficiency is allowed.

VIBRATION ON ENGINES DRIVEN UNITS

a. It has become commonplace to use internal combustion engines to drive emergency fire pumps due to reliability and other concerns. Diesel engines have become a popular choice. An engine drive is significantly different than the typical electric motor drive that many are accustomed to seeing in a water pump application.

b. There is an ISO standard referring to the vibration of reciprocating machines which may be referenced when evaluating an engine driven fire pump system.

This section of the standard provides specific guidelines for interpreting vibration levels on reciprocating machines above 100 kW. There is a severity chart with additional machine classifications as shown in Figure 8. **Classifications 5 and 6 apply to stationary diesel driven fire pump sets**. For example, an engine driven fire pump system having an overall level measured on the engine at **28 mm/sec** would be considered unacceptable for any machine in classifications 1-4. However, this level is acceptable under a class 5 or class 6 machine.

- **i.Classification number 1** - Small (up to 15kW) machines and subassemblies of larger machines
- **ii. Classification number 2** - Medium size (15kW to 75kW) machines without special foundations or machines up to 300kW rigidly mounted on special foundations. Classification number 3 - Large rotating machines rigidly mounted on foundations which are stiff in the direction of vibration measurement.
- **iii. Classification number 4** - Large rotating machines mounted on foundations which are flexible in the direction of vibration measurement.
- **iv. Classification number 5** - Machines and mechanical drive systems with un-balanceable

inertia effects (due to reciprocating parts), mounted on foundations, which are relatively stiff in the direction of vibration measurement.

- **v. Classification number 6** - Machines and mechanical drive systems with un-balanceable inertia effects (due to reciprocating parts), mounted on foundations which are relatively soft in the direction of vibration measurement.

c. Evaluation Zone descriptions:

- i. **A**.The vibration of newly commissioned machines would normally fall within this zone.
- ii. **B**. Machines with vibration within this zone are normally considered acceptable for long-term operation.
- iii. **C.** Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the machine may be operated for a limited period in this condition until a suitable opportunity arises for remedial action.
- iv. **D.** Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.

	Machine vibration classification number						
mm/sec	1	2	3	4	5	6	7
≤	Evaluation zones						
1.12	A/B	A/B	A/B	A/B	A/B	A/B	A/B
1.78							
2.82							
4.46							
7.07	C						
11.20	D	C					
17.80		D	C				
28.20			D	C			
44.60				D	C		
70.70					D	C	
112.00						D	C

TYPES OF WATER SOURCES AND TECHNICAL

1. Saltwater (Seawater)

Risks and Challenges:

- High corrosion potential
- Scale and salt deposits
- Accelerated damage to metallic components

Recommendations:

- Use corrosion-resistant materials.
- Install freshwater rinse systems to flush the system after use or testing.
- Consider vertical turbine pumps to keep motors in dry environments.
- Use valves and fittings made from compatible materials.
- Schedule frequent maintenance: check for corrosion, clean internal parts, and perform as required by NFPA-25.

2. Freshwater (Rivers, Lakes, Wells)

Risks and Challenges:

- Presence of sediments, leaves, algae, or animals
- Water level fluctuation (especially in rivers or wells)
- Possible contamination or turbidity

Recommendations:

- Install NFPA-20 compliant intake screens or strainers to prevent debris entry.
- Use vertical turbine pumps when suction lift is present.
- In lakes or rivers, consider a protected intake structure with debris barriers.
- Ensure minimum submergence to avoid cavitation and formation of vortices.
- Perform periodic inspection and cleaning of the suction strainer.

3. Ground-Level Water Tank

Risks and Challenges:

- Contamination from sediment if not maintained
- Requires full pumping (no static pressure)
- Risk of evaporation or algae if tank is uncovered

CONSIDERATIONS

Recommendations:

- Install horizontal or vertical pumps with positive suction (if the tank is lower than the pump, ensure proper priming).
- Use appropriate check and isolation valves.
- Monitor water levels using sensors or floats.
- Schedule regular tank cleaning and disinfection.
- Ensure compliance with minimum tank capacity per NFPA 22.

4. Municipal Water Supply

Risks and Challenges:

- Pressure variation depending on demand or time of day.
- Possible contaminants or backflow risksts.
- Supply interruption during emergencies or maintenance.

Recommendations:

- Conduct a flow test to verify available pressure and flow.
- Install a backflow prevention device as per local codes.
- Use a break tank to limit maximum suction pressure if required.
- Coordinate with the local water authority regarding fire demand availability
- Ensure compliance with NFPA 20 connection requirements to municipal systems.

PACKINGS

What Are They?

Packings are versatile sealing materials used in industrial applications. They are known for their resistance to high temperatures and chemicals, as well as their ability to dissipate heat effectively.

Common Types of Packing

There are various types of graphite packings designed for different applications. The type commonly used in our fire pump systems is pure braided graphite packing, made from interwoven graphite yarns, often internally reinforced with materials such as Inconel wire or glass fiber.

Why Are They Important in a Pump?

Graphite packing is critical in pumps because it provides reliable sealing under harsh conditions—high temperature, pressure, and chemical exposure. This contributes to operational safety, energy efficiency, and equipment protection.

Key Considerations:

Fluid Compatibility:

- While graphite offers good chemical resistance, certain aggressive chemicals or contaminants can compromise its integrity.

Check compatibility with:

- Strong acids
- Water with sediments or salts
- Oils or solvents

System Pressure:

- Evaluate the operating pressure. Some reinforced graphite packings (e.g., with Inconel or stainless steel) are better suited for high-pressure systems.
- Improper installation may lead to leakage or damage to the packing rings.

Pre-Startup Lubrication:

- Some graphite packings are impregnated with lubricants such as PTFE, oil, or molybdenum.

Proper lubrication minimizes wear and enhances sealing performance:

- Proper lubrication minimizes wear and enhances sealing performance.
- Before the weekly test, it's important to run the pump briefly (15–20 seconds) to allow water to flow through the system and lubricate the packing.

Proper Installation:

- Cut and install rings correctly (at 45° or 90°, alternating joints).
- Avoid over-compression: excessive tightening can damage the shaft or reduce packing life.

In some applications, a slight controlled leakage is recommended to lubricate and cool the shaft.

Shaft or Sleeve Wear:

- Graphite can be abrasive if not properly lubricated or if the fluid contains hard particles.

Periodic Maintenance and Adjustment:

- Regular inspection and adjustment of the gland follower is essential.
- Over time, the packing settles and may require slight re-tightening to maintain optimal sealing.

+75 years creating the pumping technology that moves our world

Ruhrpumpen is an innovative and efficient pump technology company that offers highly-engineered and standard pumping solutions for the oil & gas, power generation, industrial, water and chemical markets. We offer a broad range of centrifugal and reciprocating pumps that meet and exceed the requirements of the most demanding quality specifications and industry standards such as API, ANSI, UL, FM, ISO and Hydraulic Institute.

Ruhrpumpen Plants

- ARGENTINA, Buenos Aires
- BRAZIL, Rio de Janeiro
- CHINA, Changzhou
- EGYPT, Suez
- GERMANY, Witten
- INDIA, Chennai
- MEXICO, Monterrey
- UK, Lancing
- USA, Tulsa

Manufacturing plant & service center

Service center