"How to Communicate Professionally in a Technical World with Technical Information"

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Reminders

- **Cell phones – please silence**

- **Commercialism – ASHRAE observance!**

- **Please fill out the surveys**

- **My views and not ASHRAE's**

Technical Writing – What is it

- **It is a communication to convey information to an audience for a particular purpose**

- **It is a style of writing used in fields as diverse as computer electronics, engineering of all types, the aerospace industry, robotics, biotechnology, etc…**

Who Normally Creates It

- "A technical writer is someone who designs, creates, and/or maintains technical documents" (from known internet resource)

- Typical authors include engineers, scientists and other professionals which need to convey technical thoughts to others via documented communication

How We Think

- **Our Industry is mostly Left-Brain people**
  - **Good at calculations & poor at expressive thought – so there is need for better communication**
- **All Employers want employees with better communication skills**
- **Professional Communication of Technical Information is a "Thought Process"**
- **The answer is to learn "How To" develop this "Thought Process"**

Why is this Needed?

- **Texting & poor E-mail messages**
  - **? R U doing**
- **Does the reader understand the author's purpose?**
- **ASSUME – what does it spell?**
- **How did the author arrive at the stated outcome?**
- **What conclusions should the reader take away?**

What is the Goal of Technical Communication

- **To communicate your "complete" technical thoughts in a "clear" and "concise" method**

- **To provide a full understanding of your "purpose"**

- **To "persuade" the reader**

The "Thought Process"

- **Identify the "Purpose"**

- **Identify the "Audience"**

- **Identify the "Context"**

- **Provide the "Outcome"**

- **"Complete the Message"**

Identify the "Purpose"

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- **Why (reasoning) are you writing this document?**

- **What is the end result you wish to accomplish?**

- **Create a Persuasive Goal!**

Identify the "Audience"

- **Primary**

- **Secondary**

- **Gatekeeper**

- **Shadow**

- **Stakeholders**

Rate Your Audience

Readers	Needs	Values	Attitudes
Primary			
Secondary			
Gatekeeper			
Shadow			
Stakeholders			

- Each Reader needs to be assessed in each area
- The assessment process needs to evaluated (simple vs. complex) as it relates to each category
- The outcome of this assessment is to provide the writer with guidance as to the depth and detail of the "Context" & "Outcome"

Identify the "Context"

- **Starting Points**
  - **Known facts**
  - **Assumptions**

- **Explanations**
  - **How**
  - **Why**

Provide the "Outcome"

- **This is the Result of your work**

- **Include visuals (charts, illustrations, tables, etc…)**

- **Identify your visuals**

- **Explain your data**

"Complete the Message"

- **Provide a "Take Away" thought**
  - **Conclusion or reflection**

- **Create a summary**
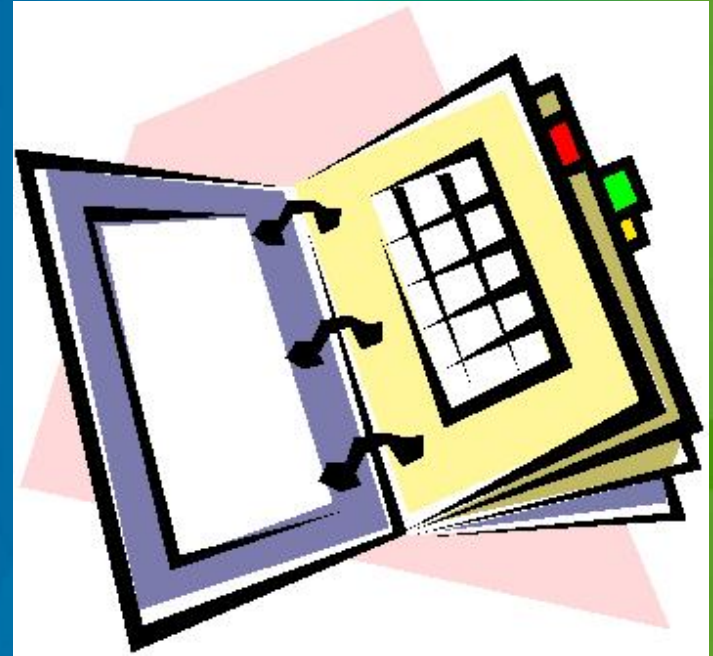 - **Condense your purpose, context and outcome**
  - **Create a final thought**

Keys to Success

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- **Understand "what you are doing" and "why"**
  - **This creates your purpose**
- **Understand your "Audience"**
- **Don't Assume as you persuade your reader**
- **Provide the reader with a "roadmap"**
- **Provide a conclusion (reflection) the reader can take away**

Suggested Format

- **Index (table of contents)**
- **Purpose**
- **Known Facts**
- **Assumptions**
- **Process**
- **Outcome (can combine with process)**
- **Conclusions (Reflection)**
- **Executive Summary (is sometimes after purpose)**
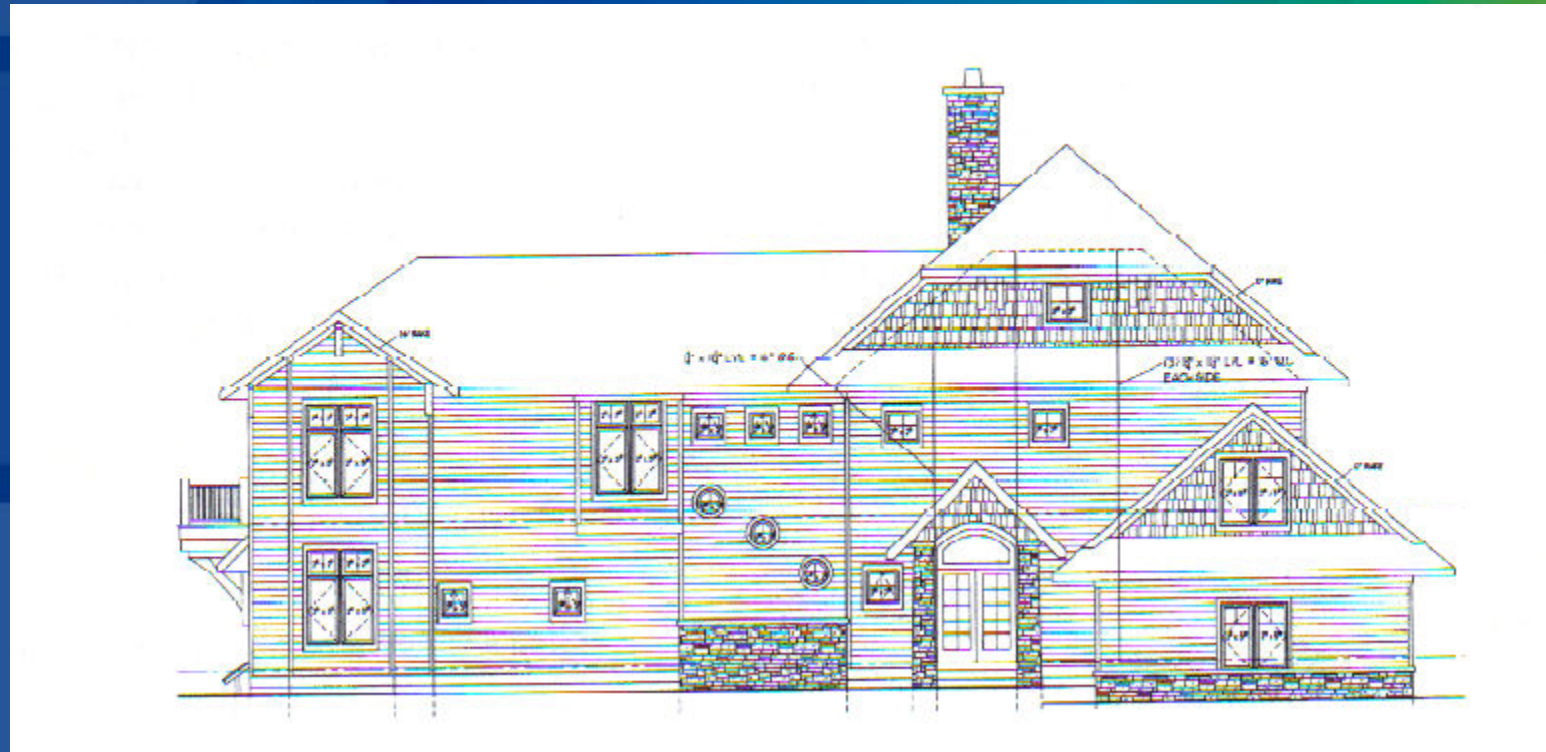
Example Report

- Custom Home

Illustration 1

Purpose Example

"This report will analyze the cold drafts within the Smith residence as it relates to the existing HVAC system, isolated exhaust fans, and integrated features of the home (windows, doors, and other potential air passage ways). The intent of this report is to evaluate the real source of unwanted cold winter drafts felt by the occupants of the home."

Known Facts Example

"The Smith residence is a custom home built within the past three years with many custom features such as; (1) in-floor radiant heating, (2) overhead delivery of heated or cooled air from a split system heat pump, (3) the heat pump system is air-cooled with a remote compressor/coil unit located outside the home on the southwest wall,

(4) three zone temperature control system from the heat pump to deliver zoned temperature control, (5) a separate humidifier which is open to the entire home, and (6) a dedicated outside air intake duct to the central fireplace."

Assumption Example

- **The cold drafts seem to be felt at the return air openings within the heat pump system, specifically the return air grilles located on the second level of the home.**

Assumption Example

- **The ventilation intake was in the soffit, but was later modified to take air from the attic.**

Assumptions Example

- **The cold air drafts seem to be felt as far as the main living area close to the fireplace. This area is close to the central return air grille in the upper ceiling of the house.**

Process Example

- **The driving force behind the "stack effect" is the pressure differential created and this delta in pressure can be illustrated with the equation below (equation 1).**

$$\Delta P = C\,a\,h \left(\frac{1}{T_o} - \frac{1}{T_i} \right)$$

Equation 1

where:

ΔP = available pressure difference, in psi

C = 0.0188

a = atmospheric pressure, in psia

h = height or distance, in ft

T_o = absolute outside temperature, in °R

T_i = absolute inside temperature, in °R

Outcome Example

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Per equation 1, the following illustrates the difference in air pressure created by the "stack effect". It is assumed the height of the chimney is 36 feet. It is also assumed the inside temperature is about 70 degrees F and the outside temperature is about 10 degrees F.

$\Delta P = (0.0188) \times (14.7) \times (36) \times [(1/470) - (1/530)]$

$\Delta P = (9.95) \times (0.0021276 - 0.0018867) = 9.95 \times 0.00024$

$\Delta P = 0.0024$ psi   1 psi = 2.31 feet of water column pressure
          Therefore;

$\Delta P = 0.0024$ psi $\times (2.31$ ft/psi$) \times (12$ in/ft$) = 0.07$ inches of water column pressure

Process Example

- **When the "stack effect" is created the resulting airflow can be calculated with the following equation (equation 2).**

$$Q = C \, A \, \sqrt{2 \, g \, h \, \frac{T_i - T_o}{T_i}}$$

Equation 2

where:

Q = stack effect draft/draught flow rate, ft³/s

A = area, ft²

C = discharge coefficient (usually taken to be from 0.65 to 0.70)

g = gravitational acceleration, 32.17 ft/s²

h = height or distance, ft

T_i = average inside temperature, °R

T_o = outside air temperature, °R

Outcome Example

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"The area within the fireplace flue is assumed to be 12" by 12" square (one square foot). If the actual flue opening is bigger the resulting real effect is greater than illustrated below. It is also assumed that the inside air temperature is 70 F and the outside air temperature is 10 F. Temperatures different than these stated assumptions result in different "stack effect" airflows."

Q = (0.65) x (1) x square root of [(2) x (32.17) x (36) x ((530-470)/530)]

Q = (0.65) x (16.2) = 10.5 cubic feet per second airflow

Q = 10.5 ft^3/sec x 60 sec/min = 630 ft^3/min (CFM)

Conclusion Example

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"**Further thoughts include the simple fact that a real long-term solution must address the combined pressure and temperature issues relevant to the fireplace and "stack effect" (Image 2).**

Without addressing recommendations #1 and #2, any other actions will not provide long-term relief to the cold weather drafts of cold air in this home."
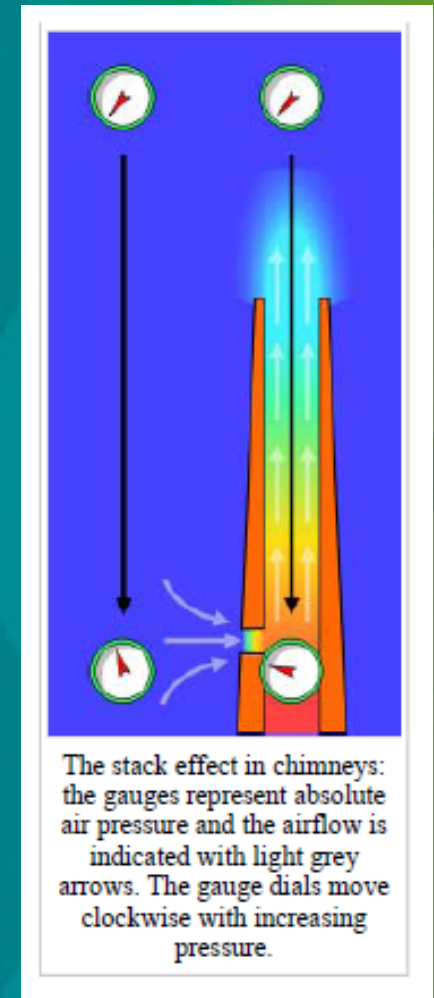
The stack effect in chimneys: the gauges represent absolute air pressure and the airflow is indicated with light grey arrows. The gauge dials move clockwise with increasing pressure.
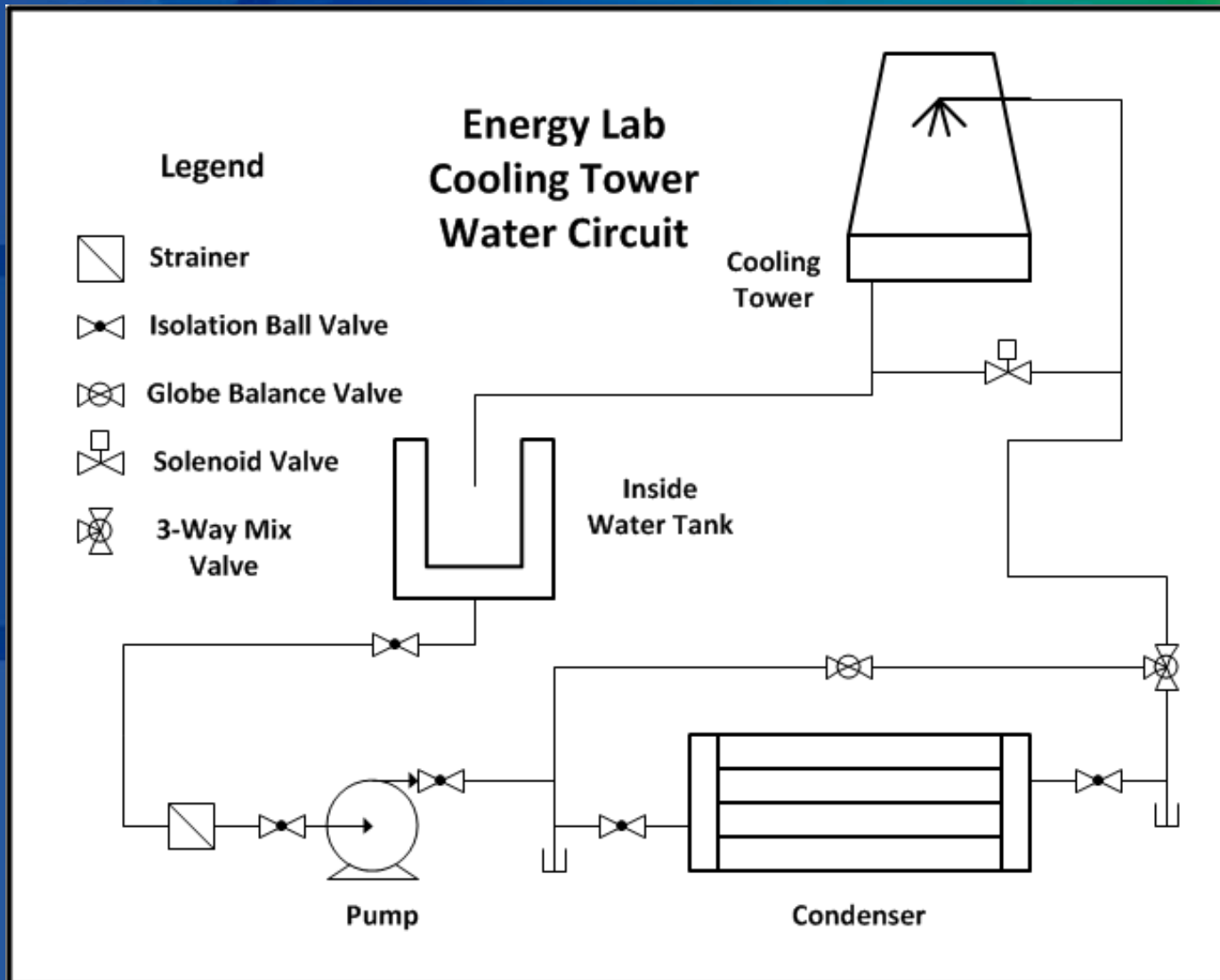
Image 2

Executive Summary Example

"The Smith custom home was analyzed relative to the building's mechanical systems, the existing openings for exhaust and fresh air, the architectural opening (fireplace/flue and connection to the garage) for potential sources of cold air drafts sensed by the home's occupants in the winter months. Through analysis it was determined that the open fireplace and flue create the "stack effect" within the Smith's home and a calculated airflow of 630 CFM was found when the outside air temperature is 10 F with an inside space temperature of 70 F."

Summary Continued

"This resulted in a negative interior space pressure and created the cold air drafts from the multiple outside air paths to the house. Solution to this issue must include an addition of glass doors to the open fireplace and a booster fan to the dedicated fresh air inlet to the fireplace."

Example #2

Purpose Example 2

"The purpose of this report is to examine the Energy Lab cooling tower loop connected to the indoor chiller and water storage tank, complete a piping diagram of this system, calculate the friction loss of its piping circuit, determine equipment pressure losses, calculate the static head on the system, and select a circulating pump impeller for the application."

Known Facts Example 2

The frictional head pressure is defined as:

$$H_f = f \times T.E.L. \quad (Eq\ \#1)$$

Where:

H_f = Total friction loss in feet of head for the piping section

f = Friction loss factor in feet of head per 100 feet of pipe

T.E.L. = Total Equivalent Length (actual measured length of pipe in feet + equivalent length of fittings and valves in the circuit)
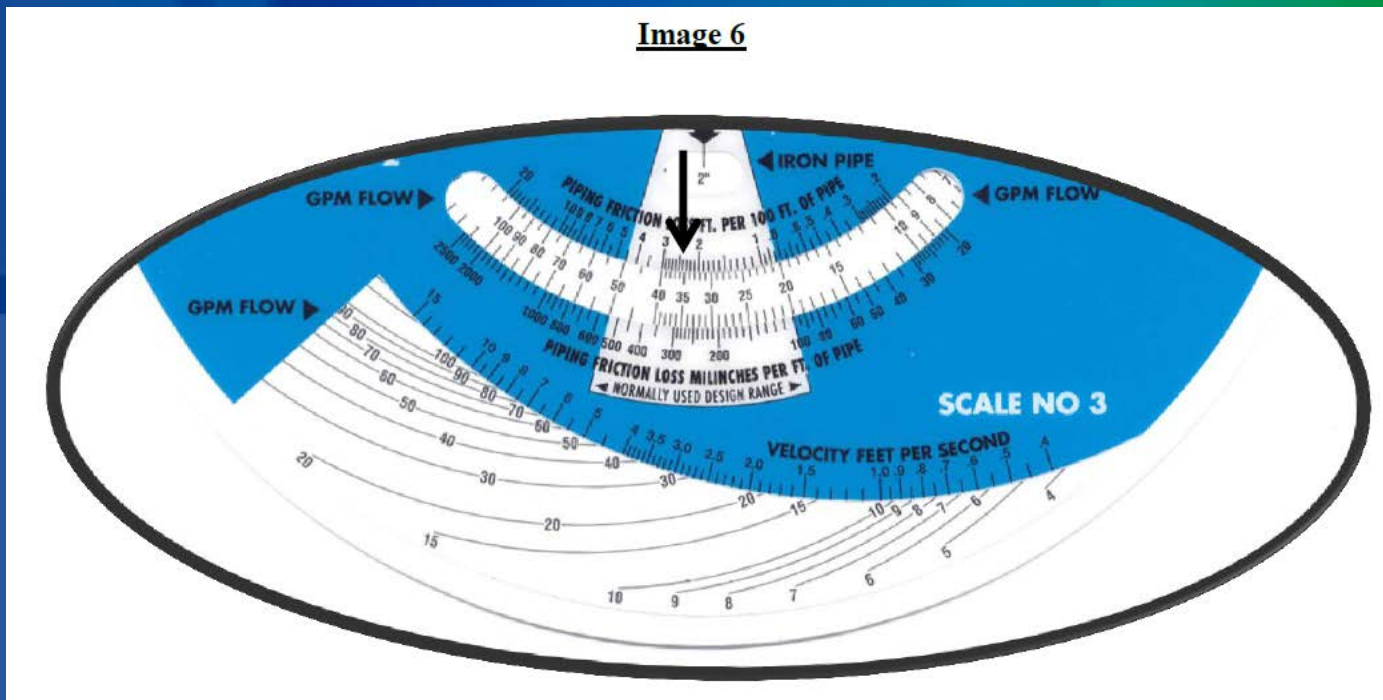
Assumptions Example 2

- The temperature of the water being pumped in the system is assumed to be close enough to 60ºF that for the purpose of this report, standard water conditions of 60ºF with a specific gravity of 1.0 will be utilized for the pump selection.

- The total piping system is assumed to have the same flow rate as is required by the cooling tower. The piping system will use iron pipe with steel threaded pipe fittings (screwed valves and fittings in the equivalent length charts).

Process Example 2

- While the pipe sizing wheel is set at 2" steel pipe, the friction factor was found by locating the system flow of 35 GPM within the flow window of scale #2 and reading the corresponding value (see Image 6).

Image 6

Conclusion Example 2

"It was concluded that sizing the pipe at 2 ½" steel pipe with 35 GPM, the related friction factor was 0.95'/100 feet of straight pipe and a water velocity of 2.3 ft/sec. The lower friction factor offset the increase in EL and produced an overall lower frictional head of 34.1 ft. w.c., then with the addition of the 8 ft. static head resulted in a Total Dynamic Head Pressure of 42.1 ft. w.c., which fell directly on the 6 1/8" impeller curve."

Outcome Example 2

"The Pump Operational Total Head Pressure is the combination of the Total Frictional Head the Static Head as illustrated below in Figure 1."
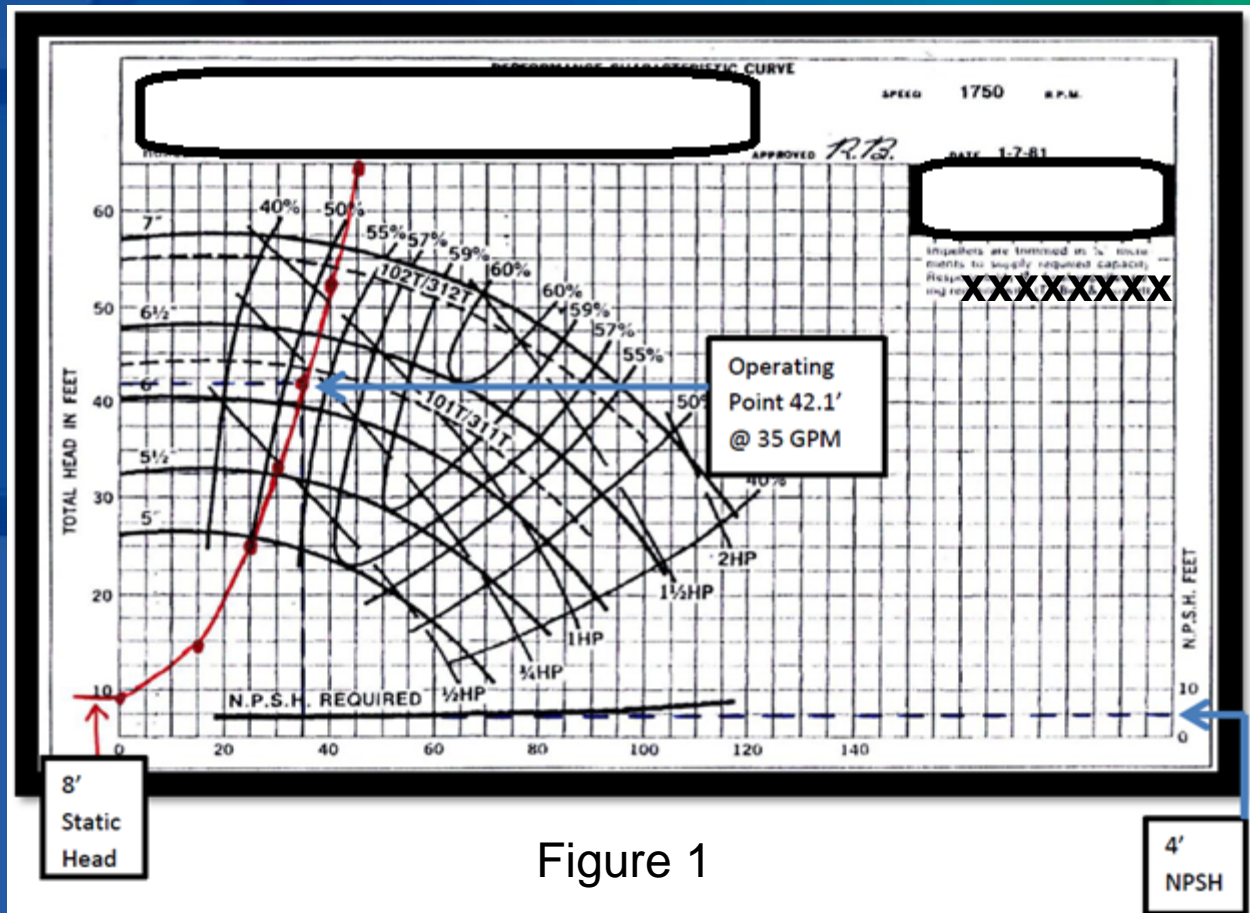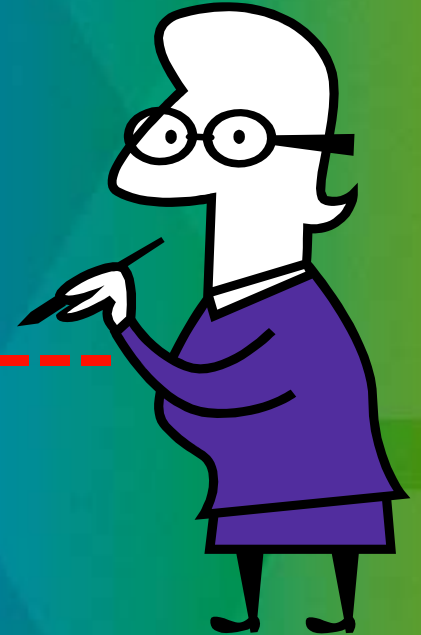

Figure 1

Applications

- **Reports**
  - **Internally**
  - **Externally**

- **Problem Solving Documentation**

Recap

- **Technical Communication is: a "Thought Process" with:**
  - **(a) Purpose**
  - **(b) Know your Audience**
  - **(c) Convey the Context**
  - **(d) Illustrate your outcome**
  - **(e) Complete your thoughts**
  - **(f) Persuade your reader, and provide a "Reflection of your Purpose".**

Experience!