

Reynolds Apparatus for ME 4621 Thermal Systems Lab

Team # 34

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Project Objective

- The objective is to design and build a Reynolds Apparatus that can:
- Effectively show the transition between laminar and turbulent flow for circular and rectangular pipes
 - Utilize an orifice flow meter for demonstration
 - Be viewed and operated remotely

Engineering Specs

Theoretical Reynolds Number

- Laminar flow: $Re < 2000$
- Transitional flow: $2000 < Re < 4000$
- Turbulent flow: $Re > 4000$

Reynolds Number Goals

- Laminar flow: $Re < 1900$
- Transitional flow: $1900 < Re < 4000$
- Turbulent flow: $Re > 4000$

Orifice Flow

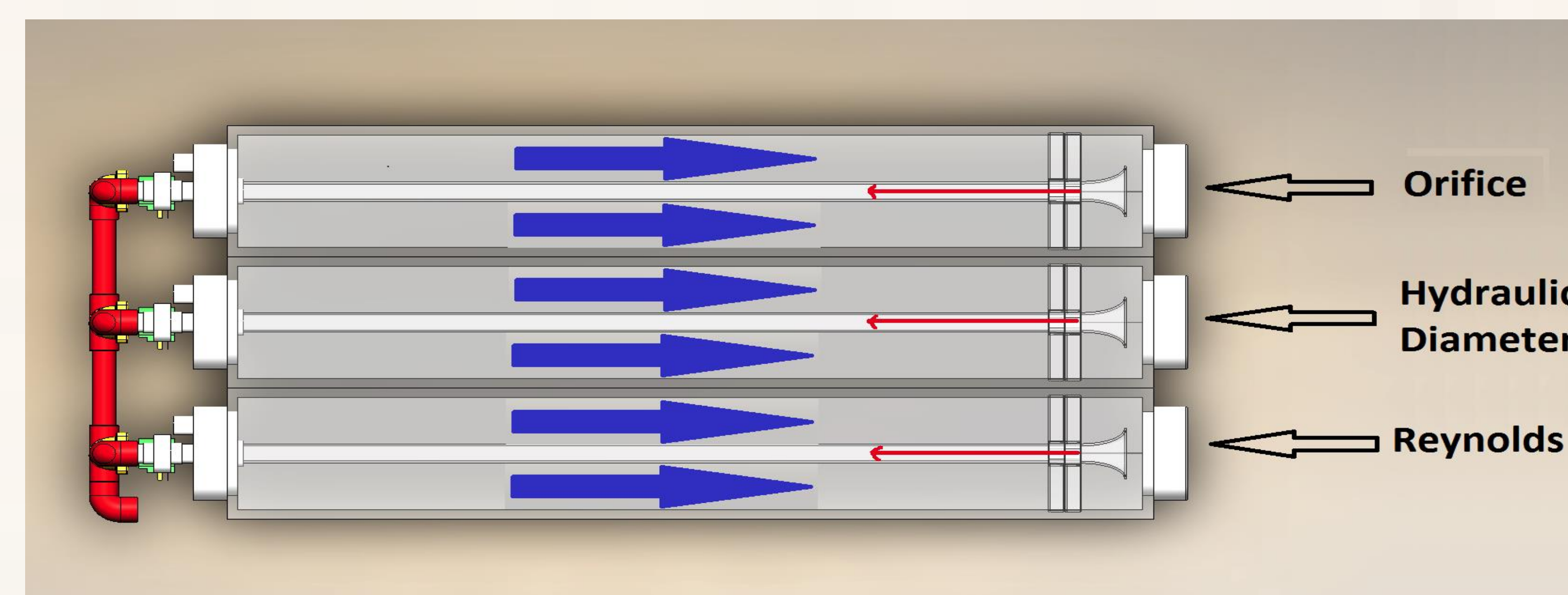
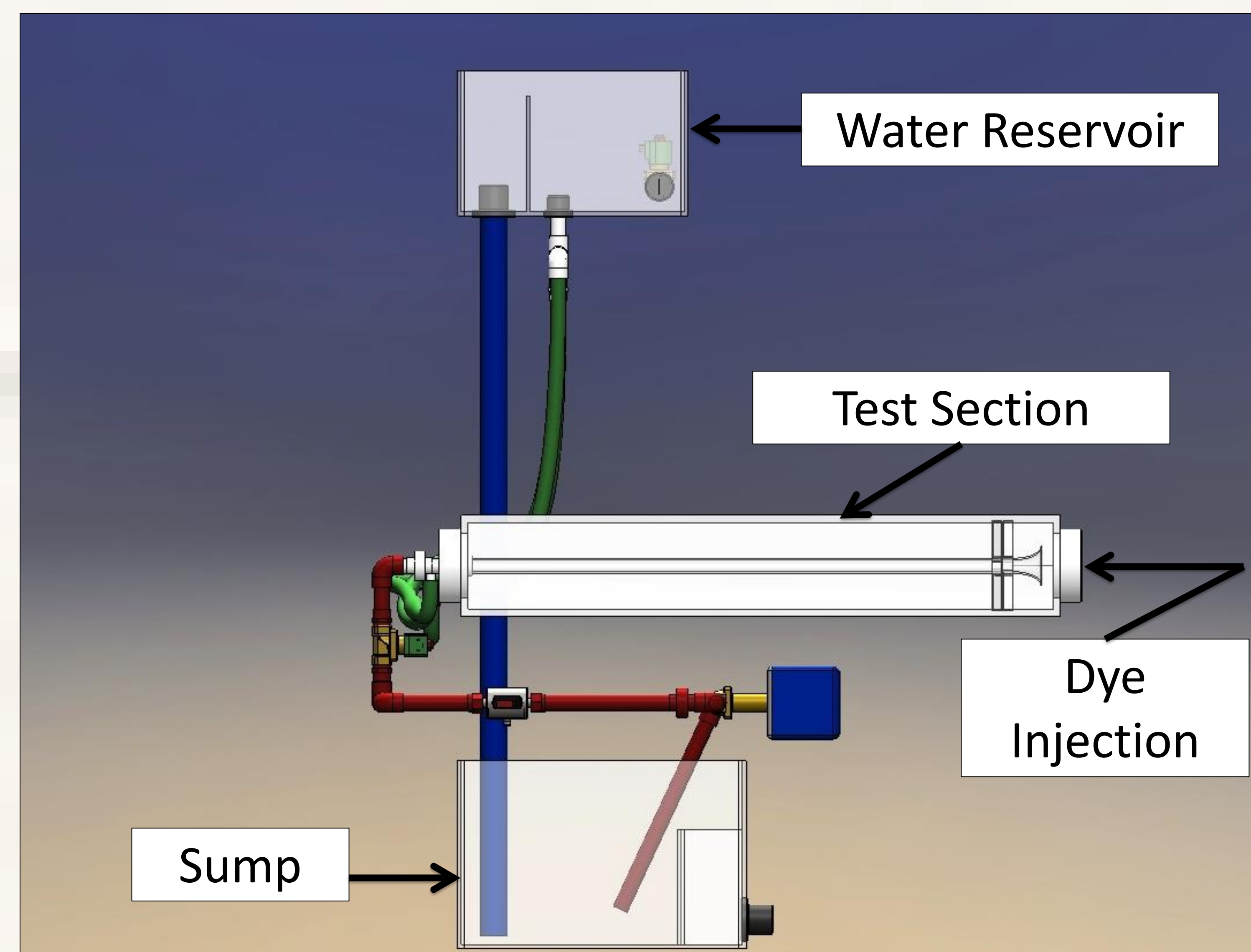
- Orifice plate loss coefficient $K = 0.82$

Hydraulic Diameter

- Dimensions to match Reynolds pipe hydraulic diameter
- Aspect Ratio < 3



Apparatus Schematic



Operation of Apparatus:

- Water flows from the lab's sink faucet to the water reservoir
- Water then flows from the water reservoir to the test section
- Dye is injected in order to observe the flow
- The mixture of dye and water runs through the flow meter and proportioning valve and into the sump
- Water in the sump flows into the lab's drain

Testing Results

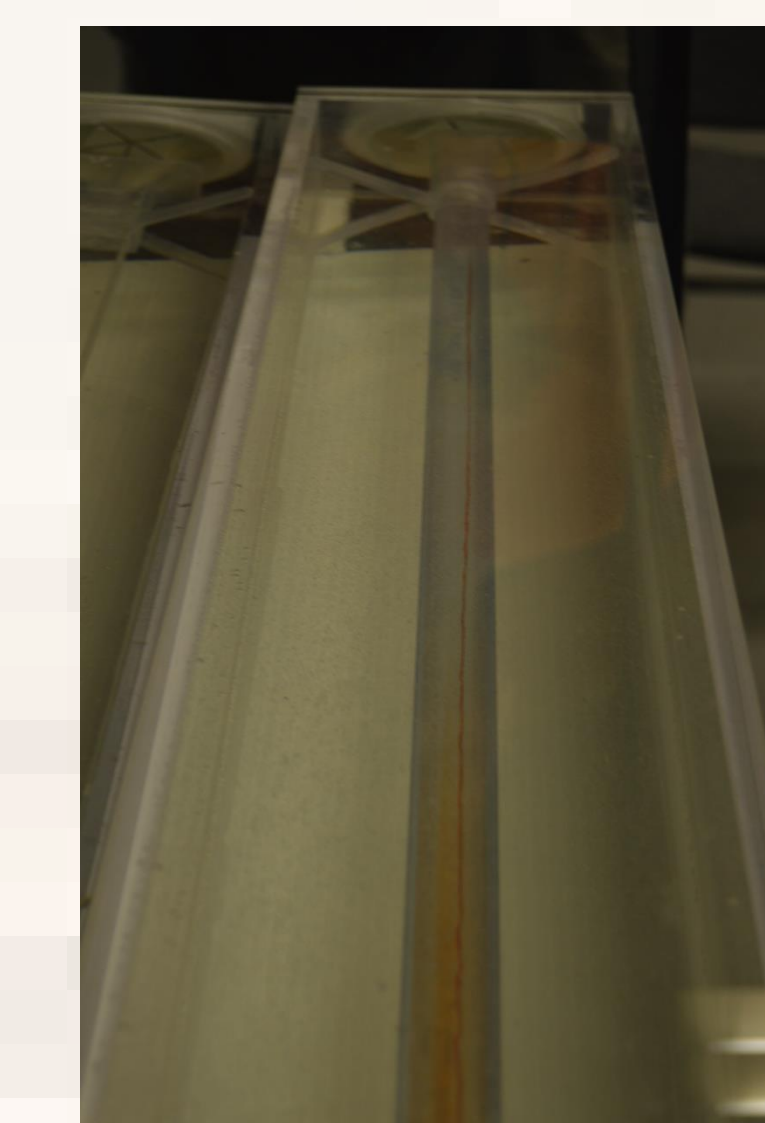
Reynolds Pipe (Reynolds Numbers)		
	Avg.	St. Dev.
Max Laminar	2250	144
Transition	2710	201
Fully Turbulent	3340	423

*Average and St. Dev. taken from 50 runs of the experiment

Hydraulic Diameter Pipe (Reynolds Numbers)		
	Avg.	Percent Difference from Circular Pipe
Max Laminar	2046	9.6%
Transition	2640	2.7%
Fully Turbulent	3520	5.2%

*Average and St. Dev. taken from 15 runs of the experiment

Dye Testing



Laminar flow through Reynolds pipe

Student Testing



Student Beta Testing

Safety

Electrical Safety

- Proper termination of wires
- Cable management
- Grounding of metal frame
- Circuit protection
- Fuses
- Shielded electronics from water exposure

Process Safety

- DAQ will shut off valves when program is not running
- Properly outlined procedure
- Current lab safety rules will apply
- Proper labeling