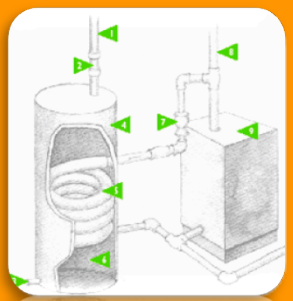
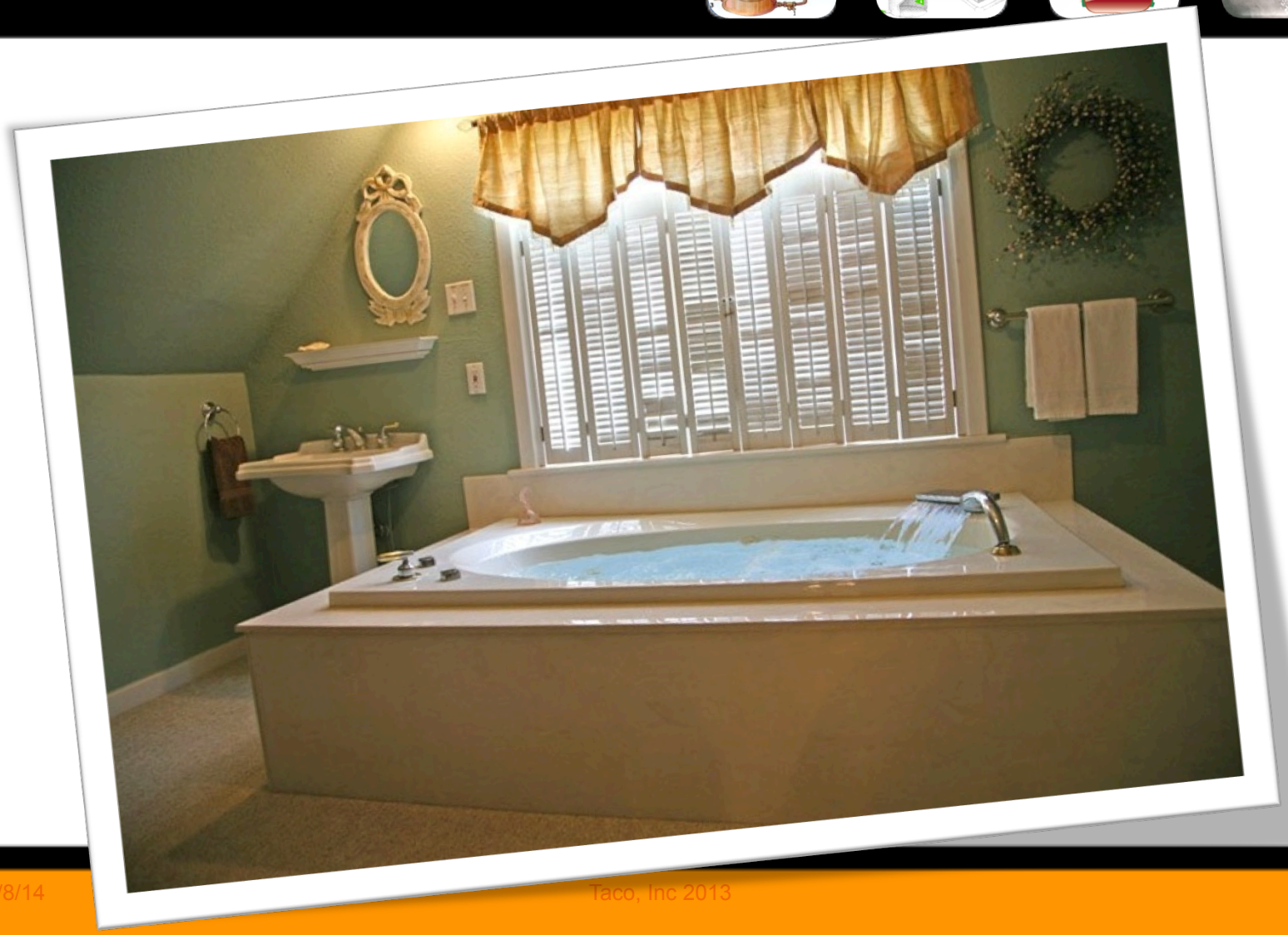
Circulators & Indirects...

What To Use



Long Ago…





Brrrr....



What's The Problem?



- Arithmetic…
- Not enough storage
- Not enough recovery

What We'll Learn Today…



- Interpret data
- Size pump/pipe
- Options

Understand The Specs



SPECIFICATIONS AND PERFORMANCE RATINGS

ULTRA RESIDENTIAL SERIES

MODEL	DIMENSIONS		CAPACITY	HEAT EXCH. SURFACE	RECOMM. FLOW RATE	PRESSURE DROP (FEET)	180° BOILER WATER FIRST HOUR RATINGS*		200° BOILER WATER FIRST HOUR RATINGS*	
	HT.	DIA.					140°F	115°F	140°F	115°F
SSU-20	27"	19 ¼"	20	15 SQ. FT.	8	6.0	121 gal	168 gal	136 gal	185 gal
SSU-30	39 ½"	19 ¼"	30	15 SQ. FT.	8	6.0	154 gal	212 gal	172 gal	234 gal
SSU-30LB	28 ½"	23 ¼"	30	15 SQ. FT.	8	6.0	169 gal	234 gal	189 gal	257 gal
SSU-45	52 ½"	19 ¼"	45	20 SQ. FT.	10	7.9	212 gal	292 gal	237 gal	322 gal
SSU-60	52 ½"	23 ¼"	60	20 SQ. FT.	10	7.9	266 gal	370 gal	298 gal	405 gal
SSU-80	72"	23 ¼"	80	34 SQ. FT.	12	9.1	330 gal	440 gal	370 gal	503 gal
SSU-119	73 ½"	27"	119	34 SQ. FT.	14	11.3	423 gal	564 gal	474 gal	645 gal

*DOE TEST METHOD BASED ON 90°F. TEMPERATURE RISE, 50°/140° W/ BOILER WATER AT 180°F

TANK SIZE	FLOOR TO BOILER SUPPLY	FLOOR TO BOILER RETURN	FLOOR TO DOMESTIC OUT	DOMESTIC CONNECTIONS	TEST PRESSURE	WORKING PRESSURE	SHIPPING WEIGHT	180 BOILER BTU/SIZE	200 BOILER BTU/SIZE
SSU-20	9"	4 ½"	22"	¾ NPT MALE	300 PSI	150 PSI	60 LBS.	84,000	87,000
SSU-30	9"	4 ½"	34"	¾ NPT MALE	300 PSI	150 PSI	72 LBS.	102,000	117,000
SSU-30LB	9"	4 ½"	23"	¾ NPT MALE	300 PSI	150 PSI	79 LBS.	114,000	131,000
SSU-45	9"	4 ½"	46"	¾ NPT MALE	300 PSI	150 PSI	88 LBS.	141,000	161,000
SSU-60	9"	4 ½"	46"	1" NPT MALE	300 PSI	150 PSI	110 LBS.	174,000	198,000
SSU-80	29"	6"	69 ¼"	1 ½" NPT MALE	300 PSI	150 PSI	141 LBS.	212,000	241,000
SSU-119	30 ¼"	7 ½"	66"	1 ½" NPT MALE	300 PSI	150 PSI	210 LBS.	269,000	301,000

© Taco, Inc 2013

The Top Chart Giveth…



MODEL	DIMENSIONS		CAPACITY	HEAT EXCH. SURFACE	RECOMM. FLOW RATE	PRESSURE DROP (FEET)	180° BOILER WATER FIRST HOUR RATINGS*		200° BOILER WATER FIRST HOUR RATINGS*	
	HT.	DIA.					140°F	115°F	140°F	115°F
SSU-20	27"	19 ¼"	20	15 SQ. FT.	8	6.0	121 gal	168 gal	136 gal	185 gal
SSU-30	39 ½"	19 ¼"	30	15 SQ. FT.	8	6.0	154 gal	212 gal	172 gal	234 gal
SSU-30LB	28 ½"	23 ½"	30	15 SQ. FT.	8	6.0	169 gal	234 gal	189 gal	257 gal
SSU-45	52 ½"	19 ¼"	45	20 SQ. FT.	10	7.9	212 gal	292 gal	237 gal	322 gal
SSU-60	52 ½"	23 ½"	60	20 SQ. FT.	10	7.9	266 gal	370 gal	298 gal	405 gal
SSU-80	72"	23 ½"	80	34 SQ. FT.	12	9.1	330 gal	440 gal	370 gal	503 gal
SSU-119	73 ½"	27"	119	34 SQ. FT.	14	11.3	423 gal	564 gal	474 gal	645 gal

*DOE TEST METHOD BASED ON 90°F TEMPERATURE RISE, 50°/140° W/ BOILER WATER AT 180°F

45 gallons on hand!

212 or 292 gallons first hour!

What's not to like???

© Taco, Inc 2013

The Bottom Chart Taketh Away…



TANK SIZE	FLOOR TO BOILER SUPPLY	FLOOR TO BOILER RETURN	FLOOR TO DOMESTIC OUT	DOMESTIC CONNECTIONS	TEST PRESSURE	WORKING PRESSURE	SH… WEI…	…80 BOILER BTU/SIZE	…BOILER …/SIZE
SSU-20	9"	4 ½"	22"	¾ NPT MALE	300 PSI	150 PSI	60 LBS.	84,000	…000
SSU-30	9"	4 ½"	34"	¾ NPT MALE	300 PSI	150 PSI	72 LBS.	102,000	…,000
SSU-30LB	9"	4 ½"	23"	¾ NPT MALE	300 PSI	150 PSI	79 LBS.	114,000	…31,000
SSU-45	9"	4 ½"	46"	¾ NPT MALE	300 PSI	150 PSI	88 LBS.	141,000	161,000
SSU-60	9"	4 ½"	46"	1" NPT MALE	300 PSI	150 PSI	110 LBS.	174,000	198,000
SSU-80	29"	6"	69 ¼"	1 ½" NPT MALE	300 PSI	150 PSI	141 LBS.	212,000	241,000
SSU-119	30 ½"	7 ½"	66"	1 ½" NPT MALE	300 PSI	150 PSI	210 LBS.	269,000	301,000

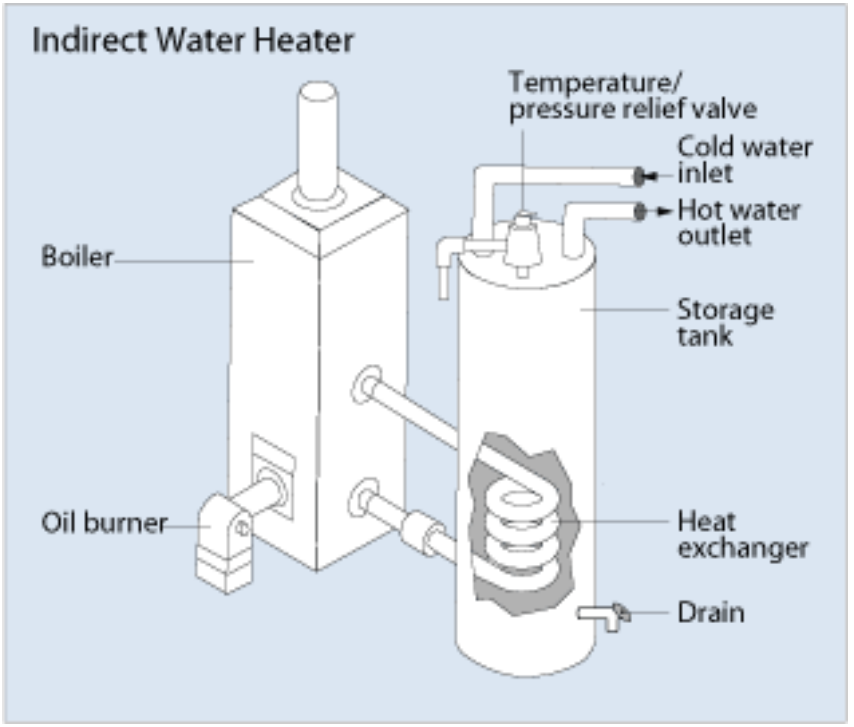
That's IF you have 141,000 BTUH at the boiler!

© Taco, Inc 2013

The Math



- ≈ 75% usable capacity
  - Coil space
  - Cold water
- 45 gallons × .75 ≈ 34 gallons available



© Taco, Inc 2013

Figuring Recovery



- BTU's & GPM
- How many GPM with BTUH available?
- Boiler Output ÷ (8.33 × 60 × 90)

  or (45,000)

Do The Math!



- 141,000 ÷ (8.33 × 60 × 90)
  - 141,000 ÷ 45,000
  - 3.13 GPM
- Call it 3 GPM
- 3 GPM × 60 min = 180 gallons

© Taco, Inc 2013

Sooo.....



- 34 gallons stored
  + 180 gallons recovered
  = 214 first hour gallons

- 214 ÷ 60 = 3.5 GPM,
  all day long!

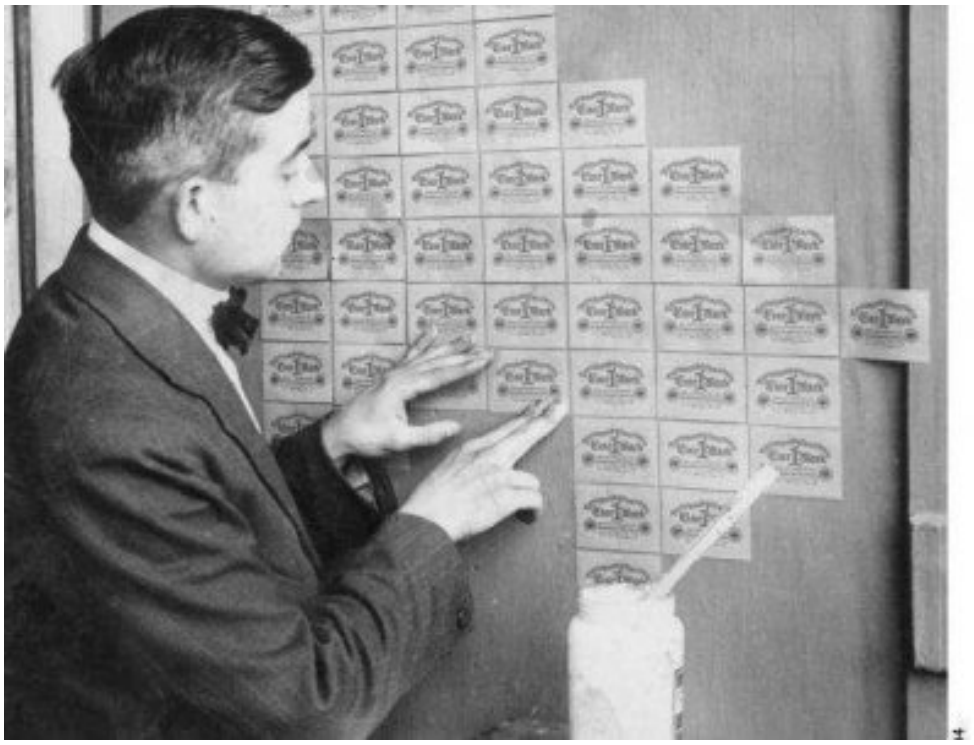
- Big IF!!!!!

© Taco, Inc 2013

Conditions



- Need 141,000 Net BTUH boiler
- Proper boiler piping
- Pick the right circulator!

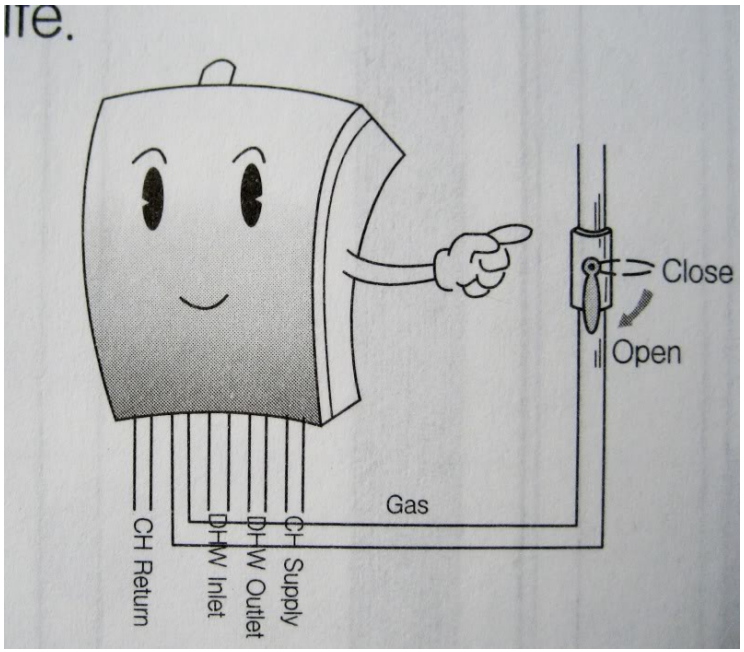


© Taco, Inc 2013

Smaller Boiler?



- Net boiler ÷ (8.33 × 60 × 90) (or 45,000)
- 75,000 ÷ 45,000
  = 1.67 GPM
- 1.67 GPM × 60
  = 100 1st hour gallons recovery



© Taco, Inc 2013

What Do We Get?



- 34 gallons stored
  + 100 gallons recovered
- 134 1st hour gallons
- < 2¼ gallons per minute
- *Should* be okay…

© Taco, Inc 2013

Pipe Sizing



MODEL	DIMENSIONS		CAPACITY	HEAT EXCH. SURFACE	RECOMM. FLOW RATE	PRESSURE DROP (FEET)	180° BOILER WATER FIRST HOUR RATINGS*		200° BOILER WATER FIRST HOUR RATINGS*	
	HT.	DIA.					140°F	115°F	140°F	115°F
SSU-20	27"	19 ¼"	20	15 SQ. FT.	8	6.0	121 gal	168 gal	136 gal	185 gal
SSU-30	39 ½"	19 ¼"	30	15 SQ. FT.	8	6.0	154 gal	212 gal	172 gal	234 gal
SSU-30LB	28 ½"	23 ½"	30	15 SQ. FT.	8	6.0	169 gal	234 gal	189 gal	257 gal
SSU-45	52 ½"	19 ¼"	45	20 SQ. FT.	10	7.9	212 gal	292 gal	237 gal	322 gal
SSU-60	52 ½"	23 ½"	60	20 SQ. FT.	10	7.9	266 gal	370 gal	298 gal	405 gal
SSU-80	72"	23 ½"	80	34 SQ. FT.	12	9.1	330 gal	440 gal	370 gal	503 gal
SSU-119	73 ½"	27"	119	34 SQ. FT.	14	11.3	423 gal	564 gal	474 gal	645 gal

*DOE TEST METHOD BASED ON 90°F TEMPERATURE RISE, 50°/140° W/ BOILER WATER AT 180°F

Recommended flow rate: 10 GPM

Coil head loss 7.9’

© Taco, Inc 2013

What's That Mean?



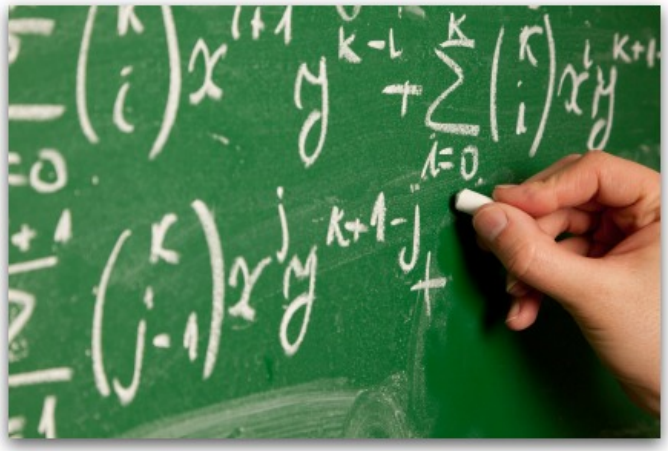
- 10 GPM = 1" pipe MIN!
- Keep tank close – minimal piping/fittings

© Taco, Inc 2013

Example



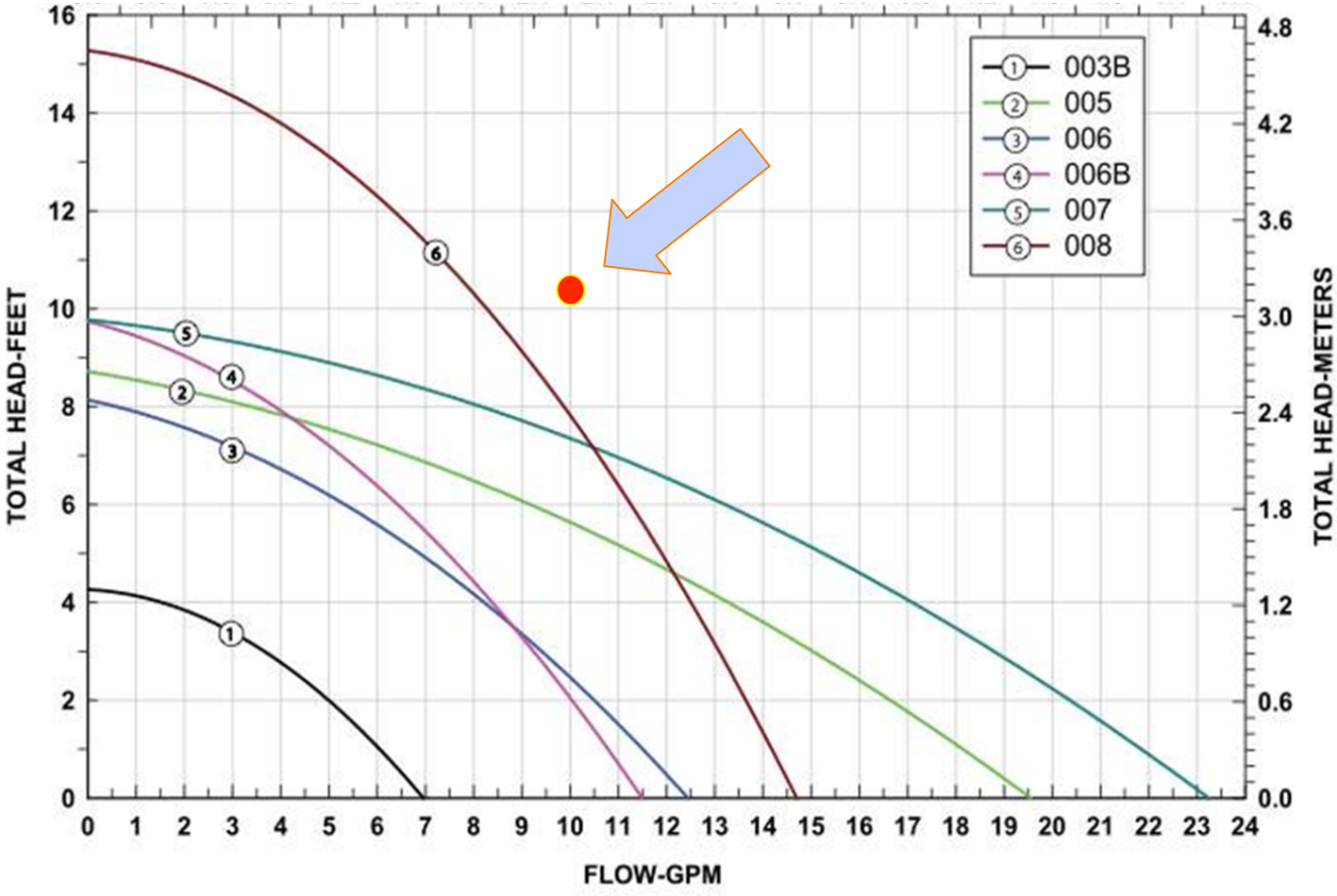
- S&R piping = 35’
- 12 90’s @ 2.5’ ea = 30’
- 65’ total × .04 = 2.6’
- 7.9’ + 2.6’ = 10.5’ total head



© Taco, Inc 2013

007? 008?



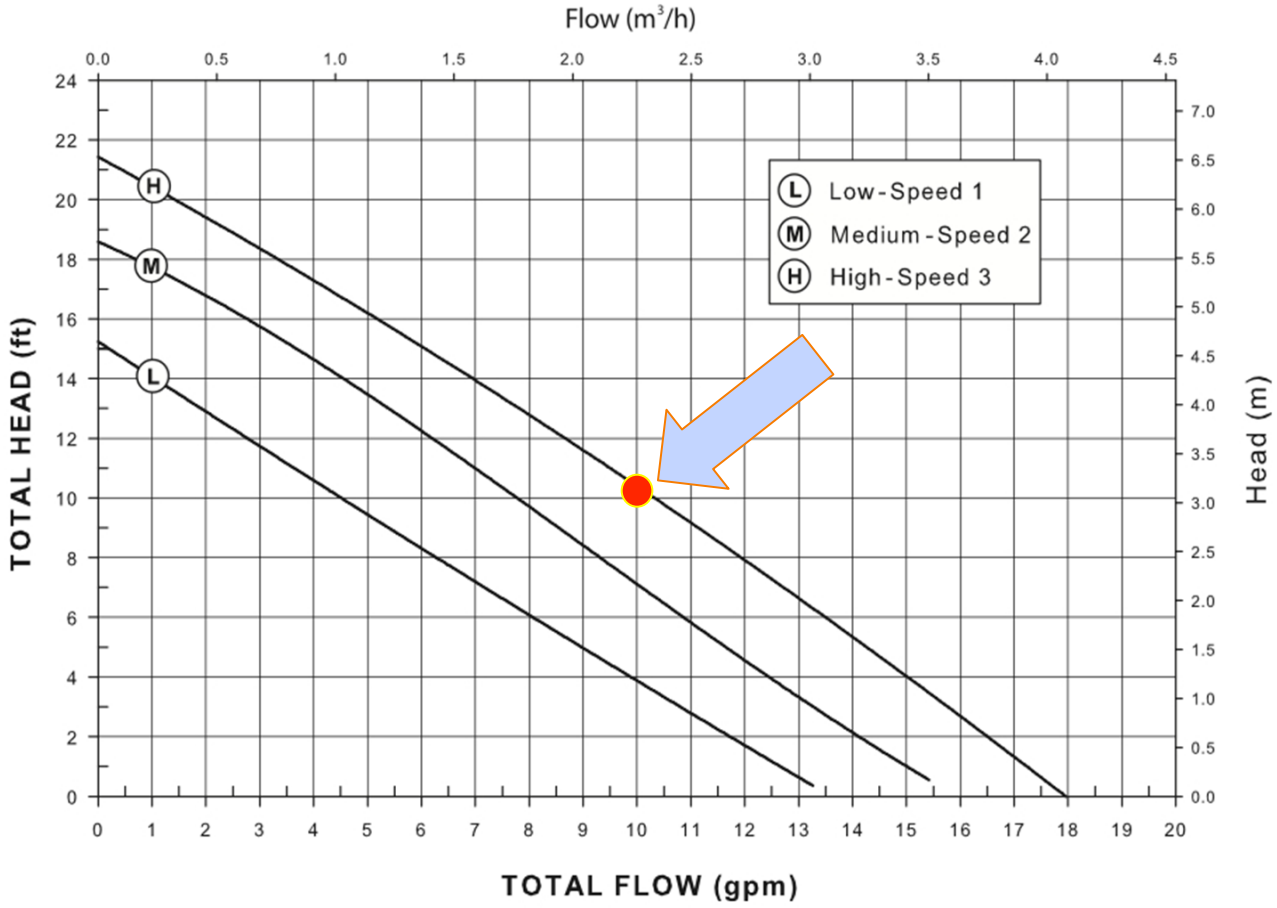


© Taco, Inc 2013

10 GPM @ 10½’



0015-MSF-IFC *Multi-Speed Circulator*



© Taco, Inc 2013

Caveats Galore



- Store @ 140^0, mix at fixture
- 90^0 ΔT worst case
- Usage varies

© Taco, Inc 2013

Temper Fi!



- Tempering valve helps
- Makes tank “bigger”
- $(T_{mix} - T_{inc}) \div (T_{stored} - T_{inc})$

  = Storage Factor

© Taco, Inc 2013

Create Capacity



- $(112^0 – 50^0) \div (140^0 – 50^0)$
- 62 ÷ 90 = .69 Stor Fac
- Usable Cap ÷ Stor Fac = Tempered Capacity
- 34 ÷ .69 = >49 gallons

Nearly 50% increase!

© Taco, Inc 2013

Let's Push The 'Ol Envelope...



- $(112^0 - 50^0) \div (160^0 - 50^0)$
- 62 ÷ 110 = .56 Stor Fac
- 34 ÷ .56 = 60 gallons

- Same usable capacity as 80 gallon tank!

© Taco, Inc 2013

One Absolute…



- Gotta gotta gotta use a fail-safe tempering valve!

© Taco, Inc 2013

Take Aways



- Size pipe to spec
- Pick right pump, speed!
- Size tank capacity to biggest load
- Watch fixture flow rates

© Taco, Inc 2013

Formulas…



- Tank capacity × .75 = usable capacity
- Recovery = Boiler Output ÷ (8.33×60×90)

  (or 45,000)
- Usable capacity + Recovery = 1st Hour
- $(T_{mix} – T_{inc}) \div (T_{stored} – T_{inc})$ = Storage factor

© Taco, Inc 2013




© Taco, Inc 2013