

**SWIMMING POOL PLAN REVIEW CALCULATIONS, COMPONENTS AND PIPING (December 2024)**

***(v) beside item # if correct; (X) if need info or not approved for plan review letter.***

**1. Pool Type and required turnover rate denominator in minutes**

Pool Type and Turnover Rates	
<b>6 Hour Turnover - divide volume by 360 minutes</b> Swimming pool (standing water 0+’ but usually 3’ min water depth) .2518(b), Water slide landing pool >60,000 gal .2543(b), Scuba pool, .2544(e)(2)	
<b>3 Hour Turnover – divide volume by 180 minutes</b> Water slide landing pool <60,000 gal with auto chemical controller .2543(b)	
<b>2 Hour Turnover - divide volume by 120 minutes</b> Wading pool (24” max depth).2531(a)(3), Water slide pools <60,000 gal without auto chemical controller .2543(b), Training pools (24-36” depth) .2543(e)(1) Exercise therapy pool and swim spa* >1000 gal .2544(d)(2) *.2544 (c) and (d) apply to swim spa	
<b>1 Hour Turnover – divide volume by 60 minutes</b> Stand- alone children’s activity pool (CAP) .2531(b)(2)	
<b>.5 Hour Turnover – divide volume by 30 minutes</b> Recreational spas, hot tubs .2532(1), Interactive Play Attractions (IAPA), Spray grounds .2543(d)(5), Exercise therapy pool and swim spa <1000 gal .2544(d)(2) Float Tank .2544(b)(4) 2X every hr. when not in use, and 2X between each user	

**(Use chart to the right)**

**2. Pool perimeter** (lengths + widths) RDP \_\_\_\_\_ FT  
(circle perimeter = πd)

**3. Pool surface area** (length X width) RDP \_\_\_\_\_ SF  
(circle area  $A = \pi r^2$ )

**4. Pool volume** RDP \_\_\_\_\_ GAL  
(length X width X avg. depth X 7.48),  
(circular is  $\pi r^2$  X avg depth X 7.48)

**5. Minimum turnover flow rate required** \_\_\_\_\_ GPM  
pool volume (Ref #4) ÷ assigned denominator (Ref #1)  
Ex. 36,000 gal. ÷ 360 min. = 100 GPM

**6. Design Flow per RDP .2518(h)** \_\_\_\_\_ GPM

Use circulation design flow rate to determine:  
 1. # of inlets .2518 (i)  
 2. filter size .2519  
 3. pipe size for suction system and return system .2518(d)

**CIRCULATION COMPONENTS**

**Circulation Pump:** Either single speed OR variable speed: NSF 50 or 3<sup>rd</sup> party approval .2518(h) - Ref NSF.org to assure NSF Approved

**6a. Single speed pumps** - TDH is assumed at 65 feet of head unless design engineer provided calculated TDH.  
 Pump mfg.: \_\_\_\_\_ Model #: \_\_\_\_\_ HP \_\_\_\_\_  
 Design Flow: \_\_\_\_\_ GPM at 65 FT TDH or RDP calculated TDH .2518(h) – used for pipe sizes .2518 (d)  
 Max flow per curve \_\_\_\_\_ GPM\* - for SOFA compliance .2539(d)(1)  
 \*Use the max flow from the pump curve unless the RDP provided head loss calculations for a flow reduction .2539 (d)(1)

**6b. Variable speed pumps OR pumps with variable frequency drives.** Variable speed pumps allow the designer to establish a “custom designed flow range” using the infinite flow ranges available on energy efficient pumps. This range will include the minimum turnover rate (Ref #5) and the maximum flow rating allowed by the system (i.e., pipe size, # of inlets, # of skimmers, filter, SOFAs, etc.) The pump can be set to a custom design flow which must fall within this range. The designer must provide a supporting pump curve and the designer should specify the most limiting component of the pump system. EHS will need to verify the most limiting component during plan review.

RDP Targeted Design Flow: \_\_\_\_\_ GPM (Ref #6) .2518 (h)

**Limiting Factors** (list the GPM for each of the following – then circle the most limiting factor:  
 main drain pipe size (Ref #11) \_\_\_\_\_, skimmer pipe size (Ref #12) \_\_\_\_\_, return pipe size (Ref #13) \_\_\_\_\_, filter rate (Ref #8) \_\_\_\_\_, # of inlets (Ref #6) X 20 \_\_\_\_\_, Flow per skimmer X # of skimmers(Ref #9) \_\_\_\_\_ .2518 (k)(2)(B), SOFA flow rating (Ref #10) \_\_\_\_\_, Other \_\_\_\_\_.

Design flow range \_\_\_\_\_ to \_\_\_\_\_ GPM (Minimum turnover (Ref #5) to most limiting factor)

Pump Mfg.: \_\_\_\_\_ Model #: \_\_\_\_\_  
 Max flow per pump curve \_\_\_\_\_ GPM (Use the lowest TDH\* on highest speed of the pump curve for SOFA compliance .2539(d)(1)

o If more than one pump connects to drains, add pump flows for total maximum flow for sizing VGB cover

\*Use the max flow from the pump curve unless the RDP provided head loss calculations for a flow reduction in which case use the RDP calculated TDH at the highest speed .2539 (d)(1).

**7. Number of inlets required** \_\_\_\_\_, Plan shows \_\_\_\_\_ (Design flow in (Ref #6) ÷ 20 GPM), min 4 for pools, min 2 for wading pools and spas, and no part of pool more than 25 ft. from any inlet, arranged to provide uniform circulation of water per .2518(i)(1-4), .2531(a)(2),.2532(3), .2532(2)  
 Inlet Mfg. & Model # \_\_\_\_\_

**8. Filter (sand, DE, cartridge) sized properly per .2519 - Reference NSF.org**

Type Filter	Filter Rate / SF
High-Rate Sand	15 – 20 gpm per sf of filter surface area
Rapid Rate Sand	3 gpm per sf of filter surface area
Vacuum Sand	15 gpm per sf of filter surface area
DE with slurry	2.5 gpm per sf of filter surface area
DE without slurry	2 gpm per sf of filter surface area
Cartridge	.375 gpm per sf of filter surface area

Filter Mfg. & Model # \_\_\_\_\_  
 Number of Filters: \_\_\_\_\_  
 Design Flow (Ref #6): \_\_\_\_\_ ≤ Filter Flow Rate \_\_\_\_\_

Design Flow Rate (Ref #6) ÷ FILTER RATE listed in chart above = SF of filter surface area required. Refer to filter specification sheet for filter surface area provided. If the filter square footage is not adequate for design flow rate, more than 1 filter will be needed or a different model # required.

**9. Surface Overflow systems: Skimmers, Gutter System, or Combined**

Number of NSF skimmers required\*: \_\_\_\_\_ Plan shows \_\_\_\_\_

\*Pool surface area (Ref #3) ÷ 400sf or fraction thereof for swimming and wading pools per .2518(k)(2)(B), .2531(a)(2), and G.S. 130A-282(c) OR (Ref #3) ÷ 100sf or fraction thereof for spas per .2532(4)(b).

Skimmers protected from air entrainment in the suction line by (circle one): auto-fill, fill spout/ hose, or flooded suction on the pump .2518 (l).

**No skimmer equalizers allowed for new construction - ANSI/ PHTA/ ICC 7 per .2518(l)**

- o Auto-fill mfg. # \_\_\_\_\_
- o Skimmer Mfg. \_\_\_\_\_ & Model # \_\_\_\_\_
- o Max flow for Skimmer provided per NSF Listing. \_\_\_\_\_ GPM; may require additional skimmers if allowed flow per skimmer is inadequate.

If Gutter system, surge tank capacity required \_\_\_\_\_ gallons Plan shows \_\_\_\_\_ gallons

- o 1 gallon surge tank capacity per SF of pool surface area required per .2518(k)(1)(B) = 1 gal X (Ref #3) This can include capacity of the piping system if submitted.

**CIRCULATION PIPING AND SUCTION OUTLETS**

**10. Circulation Drain Covers & Sumps**

**Bather accessible submerged suction outlets SOFAs are not allowed in wading pools less than 18" deep - ANSI/ PHTA/ ICC 7**

References: .2518(j)(1-3), .2532(4)(a) for spas, .2539 (a-c), ANSI/ PHTA/ ICC 7 – 2020 and ANSI/ APSP/ ICC -16 2017

Number of drains provided: \_\_\_\_\_

- o Covers listed as (Blockable / unblockable) per manufacturer (circle one) .2518(j)(1)
- o Located within 15 ft. from a side wall
- o Located in deepest section or other means for draining pool provided
- o Dual drains connected by symmetrical T pipe
- o Blockable drains at least 3' apart at center; Or blockable drains on different planes of pool structure; Or a single unblockable drain
- o Connected dual drains are less than 30' apart
- o Configuration must meet ANSI/ PHTA/ICC 7 page 7 and 8
- o If no drains are provided, there are provisions for emptying pool completely .2518(j) or .2532(4)(a) for spas.

Cover Mfg. & Model # \_\_\_\_\_, spec sheet provided (circle one) VGBA 2017 / VGBA 2008,

- o Life Span of Cover \_\_\_\_\_ years
- o Flow rating for SOFA configuration: floor \_\_\_\_\_ GPM or wall \_\_\_\_\_ GPM
- o Does flow rating exceed max flow of pump (Ref #6a or #6b)? Yes / No

**Drain sump** Use VGBA 2017 / VGBA 2008 (circle one) drain cover manufacturer installation instructions to verify sump requirements including the minimum suction pipe opening length before any reduction in pipe size for VGBA 2017 covers – ANSI/APSP/ICC-16 2017

\*\*Filed built sumps are any sump not supplied by the cover manufacturer per ANSI-PHTA-ICC 7 - 2020

Matching Manufactured Sump <u>Yes / No</u>	OR Field Built Sump** Measurements
Model # _____	Field built sump as specified by cover manufacturer. <u>Yes / No</u> Pipe size outlet of sump _____, Pipe depth _____ Pipe Orientation: side/ bottom, Sump depth _____

Hydrostatic relief valve or gravity drainage system provided per .2515 (b). Manufacturer and Model # \_\_\_\_\_

**Obtain a copy of the final drain safety data compliance form for the file signed by the engineer or architect prior to first permit.**

**11. Circulation main drain pipe size required (Use Suction pipe sizing chart below): \_\_\_\_\_” Plan shows \_\_\_\_\_”**

Pipe size must be capable of carrying **100% design flow of** circulation pump (Ref #6) .2518(c)

For spas, any flexible piping on spa shells must meet .2518(d) and T piping must be the same diameter as the main drain outlet .2532(4)(a)

12. **Skimmers pipe size** required (Use Suction pipe sizing chart below): \_\_\_\_\_ " Plan shows \_\_\_\_\_ "  
 Pipe must handle **100% of design flow rate (Ref #6)** per .2518(c). A reduction in pipe branches must be sized to handle flow of inlets in each branch.

**Or gutter system overflow pipe size** required (Use Suction pipe sizing chart below): \_\_\_\_\_ " Plan shows \_\_\_\_\_ "  
 Must handle 100% of design flow per .2518(c) (**Ref #6**).

13. **Inlet return pipe size** required (Use discharge pipe sizing chart below): \_\_\_\_\_ " Plan shows \_\_\_\_\_ "  
 Must handle 100% design flow (**Ref #6**) per .2518(d) and reduction in pipe branches must be sized to handle flow of inlets in each branch.

PVC Sch. 40 Pipe Sizing Chart per .2518(d) & ICC-7 2020										
pipe size	1"	1.5"	2"	2.5"	3"	4"	6"	8"	10"	12"
Suction PVC pipe @6ft/sec (all drains, skimmers, gutters)	16	38	63	90	138	238	540	936	1475	2093
Discharge or Returns (inlets) PVC pipe @10ft/sec	27	62	103	146	227	391	890	1559	2457	3488

14. **Disinfectant Method:** Verify NSF & properly sized per volume of pool (**Ref #4**) per manufacturer spec sheet? Yes / No **Reference NSF.org**

- o Mfg. & Model # \_\_\_\_\_
- o If salt system, cell capacity / # cells \_\_\_\_/\_\_\_\_. If salt generator is primary disinfectant, does it meet manufacturer sizing requirements Yes / No.
- o If automatic feeder pump on disinfectant system - verify method to prevent its operation when circulation pump not in operation .2535(6) Yes / No

15. **Vacuum cleaning system** provided per .2518(f):

- o Vacuum ports located on pool wall 6" - <18" below water level with self-closing caps requiring tools Yes / No
- o Skimmer vacuum to be connected to two or fewer skimmers that can be isolated from the rest of the circulation system Yes / No
- o Portable vacuum equipment to be used Yes / No
- o Vacuum piping, if separated from skimmer operation, may be suction or discharge and should be sized according to vacuum manufacturer's requirements.

16. **Valves provided:**

- o to control flow from drains, surface skimmers or surface overflow systems, .2518(c) Yes / No
- o to control vacuuming cleaning system .2518(f) Yes / No / NA

17. **Drainage discharged through air gap** from pool overflow, deck drains, and filter backwash per .2513(b) Yes / No

18. **Lighting** – Lighting required at this pool .2524 (a) due to proposed night time use or insufficient natural lighting Yes / No

- o If underwater pool lights are provided minimum wattage required \_\_\_\_\_ =.5 lumens X SF of pool (**Ref #3**).2524 (d).
- o Compare to lighting on plans and if night swimming is requested. Nighttime swimming must meet .2524(b).

19. **Minimum deck width** required \_\_\_\_\_ ft. per .2522 (a) – (e) & (i) (**Ref #3 pool surface area**)

	Outdoor Pool	Indoor Pool	Wading Pool	Spa	Interactive Play	Permanent Structure
Deck Clearance	< 1600 sf = 6 ft > 1600sf = 8 ft	5 ft	4 ft	4 ft at least ½ around	Not Required	5 ft around diving board, handrail, slide, or other permanent structure
Vertical Clearance	NA	7 ft	7 ft	7 ft	Not Required	13 ft above board See Rule .2517

.2522 (a-e, i), .2543 (10), Special purpose pools such as waterslides and wave pools may vary from the minimum requirements to accommodate features. ADA Chairs – NC Building Code enforced. New constructed pools over 300' perimeter may be required 2 access entries (lift and ramp). Lifts are permitted to infringe on pool decks but cannot block emergency egress corridors required for fire safety. Deck slope ¼ to ½"/ft to drain and slip resistant.

20. **Ladders, steps, stairs, handrails** as required Yes / No  
 If >2' deep and ≤5' at least 1 exit is required for every 75' of perimeter. For areas > 5' deep, 1 ladder or recessed step is needed in the deep portion. If pool width is > 30 ft, 2 ladders/recessed steps are required on either side near the deep end. Read all of .2521. Sun shelf with stair counts as a set of stairs. For spas refer to .2532 (12), (14)

21. **Pool bather load** \_\_\_\_\_ (Pool surface area (Ref #3) ÷ applicable # in chart below and round down) **POOL DEPTH(s)** \_\_\_\_\_

Portion of Pools <5 ft	15sf/person per .2529(1)
Portion of Pools >5 ft (-300sqft at diving boards)	24sf/person per .2529(2)
Spas, wading pools, CAP	10sf/person per .2529(3) &.2531(a)(8)
Interactive play attraction splash zone	25sf/person per .2529(4)

22. **Restroom fixtures** based on bather load (.2526). Use chart below for bath houses for male/ female facilities. At hotel, motel, condo, or apartment complex where the farthest unit is more than 300' from the pool as measured along walkways, only a toilet and lavatory are required. We recommend at least a cold-water rinse shower on the deck at any pool where a required shower with soap is exempted by 2526 (a). No soap should be allowed or required at cold water rinse showers on the deck since these showers are not a required shower per 2526.

Divide Ref #21 bather load equally between men and women.

Men	Toilet	Lavatory	Urinal	Showers	Women	Toilet	Lavatory	Showers
0-50	1	1	0	1	0-50	1	1	1
51-100	1	1	1	1	51-100	2	2	1
101-200	2	2	2	1	101-200	3	3	1
201-300	2	2	2	2	201-300	4	4	2
301-400	3	3	3	2	301-400	5	5	2
401-500	3	3	3	3	401-500	6	6	3
501-750	5	5	5	3	501-750	8	7	3

**\*If not exempt per .2526 (a), 1 shower (with soap) per every 200 bathers is required. .2526 (h), (j)**  
**\*Shower drains are enforced by the building codes department.**  
 Typically, showers with soap in bathhouses drain to sewer and cold-water rinse showers on pool decks drain to the deck drains.

23. **Chemical storage room** minimum size required 2534(2): \_\_\_\_\_sf, Plan shows \_\_\_\_\_sf  
 (min 5sf for 10,000gal + 1sf for each additional 3000gal or portion thereof up to a maximum required size of 100sf (Ref #4 - pool volume)

24. **Flow Meter:** Mfg. & Model \_\_\_\_\_  
 The flow meter range must include minimum turnover rate and the maximum flow of the pumping system based on pipe size.2518(g).  
 Flow meter range per spec sheet: \_\_\_\_\_ - \_\_\_\_\_GPM. Required flow meter range: \_\_\_\_\_ - \_\_\_\_\_ GPM  
 (Minimum turnover Ref #5): - Upper limit based on pipe sizes (Ref #11-13)  
 Return pipe diameter: \_\_\_\_\_". Does the flow meter fit the return pipe diameter per spec sheet? Yes / No  
 Required horizontal length of pipe before and after flow meter: \_\_\_\_\_" before \_\_\_\_\_" after. Plan shows: \_\_\_\_\_" before & \_\_\_\_\_" after  
 Flow meter accuracy \_\_\_\_\_% meets 10% requirement in .2518 (g) \*If the flow meter is used for a flow reduction it must be accurate to 5% per ANSI standard 7.

**WATER FEATURES OR HYDROTHERAPY JETS (if available) Use additional sheets for extra pumping systems.**

Features such as water slides, waves, rapids, lazy rivers, interactive play features can be included in main circulation system IF the drain(s) and pipe(s) are sized to handle the flow of all pumps without exceeding flow velocities in .2518 per .2543(d)(3). .2531(b)(1) requires separate feature pumps in children's activity pools so they can be turned off at times.

25. **Features such as waterfalls and decorative fountains located ON POOL DECKS** must meet the following per .2515(g)(1-6):

- o not occupy more than 20% or the pool perimeter in (Ref #2)
- o if located next to water > 5' deep, feature shall not be more than 20' wide
- o not encourage climbing above deck level with handholds and footholds.
- o walkway provided to permit free access around decorative feature as wide as the lesser of 5 feet or required deck width in .2522(e)
- o shall not obstruct the view of any part of the pool from any seating area
- o feature with moving water must be separate from pool re-circulation system. (separate plumbing with an isolation valve)

26. **Fountains installed WITHIN SWIMMING POOL** must meet the following per .2516(f)(1-5):

- o be located in water <18" in depth
- o must be recommended by manufacturer for use in public pools (not residential)
- o shall be installed in accordance with manufacturer's instructions
- o shall be separate from the circulation system
- o shall not release water at a velocity > 10' per second above water.

27. **Feature(s) Design Flow:** The designer must provide manufacturer spec sheets with flow ranges for features to operate properly and a supporting pump curve for the chosen pump to assure pump is adequate.

**Variable speed pumps OR pumps with variable frequency drives** allow the designer to establish a "custom designed flow range"  
 This range must fall between the total minimum required flow for all the features on the pump system and maximum flow allowed by the most limiting factor in the system (i.e., pipe size, the total of the maximum flow ratings for all the features on the pump system, etc)

Feature List:

- a \_\_\_\_\_ Minimum flow required \_\_\_\_\_ GPM; Maximum flow \_\_\_\_\_ GPM
- b \_\_\_\_\_ Minimum flow required \_\_\_\_\_ GPM; Maximum flow \_\_\_\_\_ GPM
- c \_\_\_\_\_ Minimum flow required \_\_\_\_\_ GPM; Maximum flow \_\_\_\_\_ GPM
- d \_\_\_\_\_ Minimum flow required \_\_\_\_\_ GPM; Maximum flow \_\_\_\_\_ GPM

(use back to document additional features)

**Feature pump system limiting factors** (list the GPM for each of the following – then circle the most limiting factor):

Feature suction pipe size (Ref #28) \_\_\_\_\_, feature return pipe size (Ref #30) \_\_\_\_\_, Total combined maximum flow of all the features on the pumping system \_\_\_\_\_, Other \_\_\_\_\_.

Feature pump system design flow range \_\_\_\_\_ - \_\_\_\_\_ GPM

(Total combined minimum flow required with all features on – Most limiting factor)

Feature pump design flow specified by the RDP \_\_\_\_\_. Is the RDP design flow within the feature pump system design flow range? Yes / No

Pump Mfg.: \_\_\_\_\_ Model #: \_\_\_\_\_

Max flow per pump curve \_\_\_\_\_ GPM (Use the lowest TDH\* on highest speed of the pump curve for SOFA compliance .2539(d)(1)

- o If more than one feature pump connects to feature drains, add flows from all the pumps connected for sizing VGB cover

\*Use the lowest TDH from the fastest speed unless the RDP provided head loss calculations for a flow reduction in which case use the RDP calculated TDH at the highest speed .2539 (d)(1).

**28. Feature pump suction pipe size required \_\_\_\_\_ " Plan shows \_\_\_\_\_ "**

Use suction pipe sizing chart in this document .2518 (d); Pipe size must be capable of carrying **100% of the max. design flow range (Ref #27)** of feature pump provided .2518(c). Use top of the feature flow range for sizing pipe. Any flexible piping on spa shells meets .2518(d)

**29. Feature Drain Covers & SUMPS**

**Bather accessible submerged suction outlets SOFAs are not allowed in stand-alone wading pools less than 18" deep - ANSI/ PHTA/ ICC 7**

References: .2518(j)(1), 2518(j)(3), .2532(4)(a) for spas, ANSI/ PHTA/ ICC 7 – 2020 and ANSI/ APSP/ ICC -16 2017

Number of drains provided: \_\_\_\_\_

- o Cover listed as (blockable / unblockable) per manufacturer (circle one) .2518(j)(1)
- o Located within 15 ft. from a side wall
- o Located in deepest section or other means for draining pool provided
- o Dual drains connected by symmetrical T pipe.
- o Blockable drains at least 3' apart at center; Or blockable drains on different planes of pool structure; Or a single unblockable drain
- o Connected drains are less than 30' apart
- o Configuration must meet ANSI/ PHTA/ICC 7 page 7 and 8
- o If no drains are provided, there are provisions for emptying pool completely .2518(j)

**Cover Mfg. & Model # \_\_\_\_\_ VGBA 2008 / 2017 (circle one) spec sheet. Life Span of Cover \_\_\_\_\_ years**

**Maximum Flow of Drain Cover: \_\_\_\_\_ GPM, floor \_\_\_\_\_ or wall \_\_\_\_\_,**

(Cover rating must be higher than max feature pump flow .2539(d)(2).)

**Feature drain sump**

\*\*Field built sumps are any sump not supplied by the cover manufacturer per ANSI-PHTA-ICC 7 - 2020

Matching Manufactured Sump <u>Yes / No</u>	OR Field Built Sump** Measurements
Model #	Field built sump as specified by cover manufacturer. <u>Yes / No</u> Pipe size outlet of sump _____, Pipe depth _____ Pipe Orientation: side/ bottom, Sump depth _____

**Obtain a copy of the final drain safety data compliance form for the file signed by the engineer or architect prior to first permit**

**30. Feature return pipe size required \_\_\_\_\_ " Plan shows \_\_\_\_\_ "**

(Use return pipe sizing chart in this document.2518(d). Pipe size must carry 100% discharge design flow of feature pump provided (Ref #27). Use top of the range (Ref #27) for sizing pipe. Check branch pipe sizes for flow to each feature.