

# Water Test

Each water test shall consist of pumping the bin out to its lowest level and then filling the bin to capacity with water, taking ullage and draft measurements at both levels to determine bin volume and displacement. The objective of the water test is to assure data consistency by comparing the system-calculated water specific gravity to the value determined by analyzing a water sample retrieved from the bin.

If the results of the water test indicate that the system is not operating within acceptable accuracy, the Contractor shall be required to correct the deficiencies causing the error and repeat the water test until the results are acceptable.

**Purpose:** The objective of the water test is to assure accuracy of the scow's reported displacement and bin volume. In order to conduct this test successfully, proper operation of ullage and draft sensors is necessary. By filling the bin with water, the calculated density of the water can be compared to that of the water sampled from the bin, and the value of Tons Dry Solids can be calculated and should equal zero.

## Material Required:

- 1) A copy of the SCIF spreadsheet and portable computer
- 2) Auxiliary vessel to observe vessel hull draft markings
- 3) Handheld radio to communicate with auxiliary vessel (if needed)
- 4) Water sampling device to retrieve a water sample from the bin
- 5) A refractometer with automatic temperature compensation to determine the specific gravity of the bin water sample. The refractometer shall be capable of measuring the bin water's specific gravity with a resolution of 0.001 and minimum accuracy of  $\pm 0.001$ . Distilled water should be available for calibration of the refractometer.

## Procedure:

*Note: It is strongly recommended that all instrumentation is in calibration prior to this test being conducted by a COR.*

With the scow light and washed clean of dredge material, the bin is filled with just enough water so that the ullage sensors have a uniform fore and aft surface to provide a consistent measurement, and manual soundings can be taken relative to the bin datum (zero ullage) in the vicinity of the sensor. Three soundings are taken forward and aft, at port, starboard and centerline. On some scows this is not possible and either port/starboard or centerline soundings will be taken by a representative of the SI support team and a crew member familiar with sounding the bin record the soundings. While these measurements are being taken, the launch will read the draft marks in feet and tenths of feet. These manual draft measurements are communicated to the inspector on the scow. These measurements are taken simultaneously to insure that the readings are reflective of a steady state ship. The inspector also records the corresponding electronic readings from the SI system. The bin is then filled with water and the above steps are repeated. While the bin is full, a small water sample from the bin is collected to calculate

the specific gravity of water. Use the refractometer to determine its density. Record this value in the spreadsheet. From the DPIP enter the horizontal offsets between the ullage sensors and the horizontal offsets between the draft sensors.

After all values are entered into the spreadsheet, observe the calculated value of Tons Dry Solids. The acceptable accuracy is from -200 LT to +200 LT. The difference between the bin measured water density and the spreadsheet calculated water density should be within (plus or minus) 5.0%. The calculated value of trim-trim angle should be 0.3 degrees or less.

If the calculated water density is outside the acceptable range look at the draft and ullage sensor difference. If either of these differences is outside the acceptable range for the corresponding sensors then the long hand calculation sheet should be completed by someone experienced with stability and trim calculations, contact the SI support center if you need assistance. If the draft and ullage values are within acceptable ranges, both light and loaded, then discretion should be taken and numbers should be re-checked. If the water test results still don't agree then the validity of the tables will come into question and other redundant methods of calculation should be attempted though use of the stability and trim booklets on the vessel and/or its hydrostatic tables.

Draft, Ullage, Water Tests, and Trim Trim Tests						
	Time	Zone				
START						
	END	Time	Zone			
<b>Light Drafts</b>						
	Manually Measured			SI Drafts		
	Port	Stbd	Average (ft)	Instruments	Difference (ft)	
Fwd			0		0	
Aft			0		0	
<b>Light (residual/almost empty) Ullage-Level Check</b>						
	Manually Measured			SI Ullage		
	Port	Stbd	Center	Average (ft)	Instrument	Difference (ft)
Fwd				0		0
Aft				0		0
<b>Light Ship Displacement (Long Tons)</b>				<b>Residual Hopper Volume (yrds^3)</b>		
<b>Loaded Drafts</b>						
	Manually Measured			SI Drafts		
	Port	Stbd	Average (ft)	Instruments	Difference (ft)	
Fwd			0		0	
Aft			0		0	
<b>Loaded (Full) Ullage-Level Check</b>						
	Manually Measured			SI Ullage		
	Port	Stbd	Center	Average (ft)	Instrument	Difference (ft)
Fwd				0		0
Aft				0		0
<b>Loaded Displacement (Long Tons)</b>				<b>Loaded Hopper Volume (yrds^3)</b>		
Was overflow used to minimize foam generation?				Yes/No		
Did SI system show doors open?				Yes/No		
Water Specific Gravity in Hopper						(kg/cubic meter)
Longitudinal separation of ullage sensors						(ft)
Longitudinal separation of draft sensors						(ft)
<b>Water Test and Trim Trim Results</b>						
Light Ship - Loaded Ship Weight			0	Loaded hopper weight/Weight of dredged material (LT)		
Mass of Dredged material (kg)			0	Mass of Dredged material (kg)		
Hopper volume - Residual*0.7646			0	Volume (cubic meters)		
Density of Solids (kg/cubic meter)				BASELINE COULD BE 2750 KG/CUBIC METERS		
Density of Water * 1000			0			
mass/volume equals density			#DIV/0!	TDS calculation (kg)		
Calculated Tons Dry Solids			#DIV/0!	TDS calculation (LT)		
Calculated water density			#DIV/0!	Calculated water density		
% difference			#DIV/0!	Percent water density error		
Ullage Angle (SI data)			#DIV/0!			
Draft Angle (SI data)			#DIV/0!			
Trim Trim Angle (Delta)			#DIV/0!			

Long Hand Checks						Version 9
Inspector measured		Inspector records from SI - readings		Inspection sheet results		
Position Check, Ullage Checks, Draft and Displacement Check, Drag Head Depth Check, Trim Trim, System Check and Deliverable Check						
Scow Name:	0			Date:	00-Jan-00	
Personnel:	0					
Wind Conditions:	0					
Estimated Average Wave Height:	0					
Draft, Ullage, Relative Water, and Trim Trim Tests						
START	Time	Zone		End	Time	Zone
Light Drafts						
	Manually Measured			SI Drafts		
	Port	Stbd	Average (ft)	Instruments	Difference (ft)	
Fwd	0	0	0	0	0	
Aft	0	0	0	0	0	
Light (residual/almost empty) Ullage-Level Check						
	Manually Measured			SI Ullage		
	Port	Stbd	Center	Average (ft)	Instrument	Difference (ft)
Fwd	0	0	0	0	0	0
Aft	0	0	0	0	0	0
Liner Interpolation						
Light Draft						
	Table		Disp	ullage	Disp	
	Draft	Displacement	Delta	Increment	Delta	
Lesser Draft from table			0	#DIV/0!	#DIV/0!	
Larger Draft from table						
Draft	0	#DIV/0!				
Or Displacement Equation						
Light Ullage						
	Table		Vol	ullage	Disp	
	Ullage	Volume	Delta	Increment	Delta	
Lesser Hopper Ullage from table			0	#DIV/0!	#DIV/0!	
Larger Hopper Ullage from table						
Hopper	0	#DIV/0!				
Or Ullage Equation						
Light Ship Displacement (Long Tons)			Residual Hopper Volume (yrds^3)			
0			0			
Loaded Drafts						
	Manually Measured			SI Drafts		
	Port	Stbd	Average (ft)	Instruments	Difference (ft)	
Fwd	0	0	0	0	0	
Aft	0	0	0	0	0	
Loaded (Full) Ullage-Level Check						
	Manually Measured			SI Ullage		
	Port	Stbd	Center	Average (ft)	Instrument	Difference (ft)
Fwd	0	0	0	0	0	0
Aft	0	0	0	0	0	0
Liner Interpolation						
Loaded Draft						
	Table		Disp	ullage	Disp	
	Draft	Displacement	Delta	Increment	Delta	
Lesser Draft from table			0	#DIV/0!	#DIV/0!	
Larger Draft from table						
Draft	0	#DIV/0!				
Or Displacement Equation						
Loaded Ullage						
	Table		Vol	ullage	Disp	
	Ullage	Volume	Delta	Increment	Delta	
Lesser Hopper Ullage from table			0	#DIV/0!	#DIV/0!	
Larger Hopper Ullage from table						
Hopper	0	#DIV/0!				
Or Ullage Equation						
Loaded Displacement (Long Tons)			Loaded Hopper Volume (yrds^3)			
0			0			
Was overflow used to minimize foam generation?						
			Yes/No			
Did SI system show doors open?						
			Yes/No			
Water Specific Gravity in Hopper				(kg/cubic centimeter)		
Longitudinal separation of ullage sensors				(ft)		
Longitudinal separation of draft sensors				(ft)		
TrimTrim Results						
Light Ship - Loaded Ship Weight	0	Loaded hopper weight/Weight of dredged material (LT)				
Mass of Dredged material (kg)	0	Mass of Dredged material (kg)				
Hopper volume - Residual*0.7646	0	Volume (cubic meters)				
Density of Solids (kg/cubic meter)		BASELINE COULD BE 2750 KG/CUBIC METERS				
Density of Water * 1000	0					
mass/volume equals density	#DIV/0!	TDS calculation (kg)				
Calculated Tons Dry Solids	#DIV/0!	TDS calculation (LT)				
Calculated water density	#DIV/0!	Calculated water density				
% difference	#DIV/0!	Percent water density error				
Ullage Angle (Measured Data)	#DIV/0!					
Draft Angle (Measured Data)	#DIV/0!					
TrimTrim Angle (Delta)	#DIV/0!					