Fire Apparatus and Equipment
Marketing Newsletter

July 1998

Understanding ISO Ratings. The Insurance Services Office, Inc. (ISO®) evaluates fire departments in the United States. Based on this evaluation, they assign a rating between 1 and 10 for each department -- 1 being the best and 10 being the worst. This rating reflects the overall effectiveness of the department and helps determine the fire insurance premiums for property owners in that department's jurisdiction.

The ISO rating is based on the total number of points in three categories: fire department (worth 50 pts), water supply (worth 40 pts), and communications (worth 10 pts). Each of these three categories is further divided into various sub-categories. For example, the fire department category includes points for apparatus, staffing, training, and the distribution of stations. The water supply category includes points for sustained flowrate, water system maintenance, type of supply, etc. Scoring 90.00 or more total points out of 100 earns a Class 1 rating, 80.00 to 89.99 points earns a Class 2, and so on.

For departments that protect properties in areas both with and without hydrants, ISO may assign two ratings. For purposes of definition, ISO defines any property within 1000 feet of a hydrant as "city," and any property further than 1000 feet from a hydrant as "rural." Thus many fire departments have dual ratings like 4/9 or 5/8, where the city (area with hydrants) rating is listed first and the rural (area without hydrants) rating second.

Improving a department's ISO rating is more than just an ego boost for the chief. It can, and does, result in a significant cost savings on fire insurance for every property owner within the jurisdiction. And it doesn't have to be a big improvement in ISO rating either. Clay County Fire Department in Florida lowered their rating from Class 9 to Class 8 and saved homeowners about $178 a year on a $60,000 home or $479 a year on a $175,000 home. The Norwood Redvale Fire District in Colorado dropped from a Class 9 to a Class 7 and saved homeowners an average of $960 a year.

The smart departments are the ones that can translate those kinds of fire insurance cost savings into increased budgets for apparatus and equipment.....and that's where you come in. *All the money in the world won't help lower a department's ISO rating if they spec the wrong equipment or don't understand how the ratings are determined.* You can help them on both counts. In this issue I'll review how ISO rural ratings are determined with an emphasis on the critical area of water supply. I'll also review some apparatus and equipment specs that will help you give your customers the most for their money.

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ISO Ratings for Rural Departments. ISO rural ratings are based on the same three categories as city ratings: fire department, water supply, and communication. The only difference is that rural water supply ratings are based on developing a water flow where the nearest hydrant is greater than 1000 feet from the protected structure. In many cases, there isn't a hydrant within several miles of the structure, and all the water must be transported by large-diameter hose relay or by tanker (tender) shuttle from a static source.

Here is a summary of the minimum water supply requirements for ISO Class 10 through 8. *Keep in mind that these requirements are only part of the overall ISO rating:*

Class 10. No fire protection

ISO assigns a Class 10 rating to all areas greater than 5 road miles from the nearest fire station or where the responding fire apparatus does not meet the minimum requirement of Class 9. Class 10 also applies to departments that have not been rated.

Class 9. 50 gpm @ 150 psi and 300 gallons of water

A brush truck with a permanently mounted 50* gpm @ 150 psi pump and a 300* gallon tank are all that's needed to meet the water supply requirements for Class 9. The truck must be housed within 5 road miles of the protected structure. Several other conditions apply. Despite these bare-bones requirements, *many brush trucks do not qualify because the pump cannot produce 50 gpm @ 150 psi.* (See Engine-Driven Portable Pumps That Meet ISO Class 9 Requirement and Specing Pumpers to Improve ISO Ratings.)

Residential Class 8. 200 gpm @ 150 psi for 20 minutes

This is a special rating that applies to residential dwellings in some Western states. *It does not apply in all states.* Any combination of pumpers and tankers with a 200* gpm @ 150 psi pump and 4000+* gallons of water will meet Residential Class 8. The apparatus may be stationed in different locations, but have to respond at the same time and must be within 5 road miles of the protected structure. A combination of a pumper and one or more tankers is usually required. (This rating is sometimes called Dwelling Class 8)

Class 8. 250 gpm @ 150 psi for 2 hours (120 minutes)

This is a benchmark rating. *A department cannot get a Class 8 or lower rating, no matter how many points they score in other categories, if they cannot move 250* gpm for 2 hours.* To meet this requirement, a tanker shuttle or hose relay is usually required to move 30,000+* gallons. The first due units must be within 5 miles of the protected structure.

* ISO calculates flowrates and tank capacities using specific procedures and factors. (See How ISO Calculates Pump Flowrate, How ISO Calculates Water Tank Capacity, and How ISO Calculates Tanker Shuttle Flowrate.)

ISO Rural Ratings -- It's the Water!. Looking at the water supply requirements above, you would think that many departments should have no lower than a Residential Class 8 rating. In reality, some of the largest paid departments in the United States have a rural Class 9. To quote an old Olympia beer ad, "It's the water!". A 1500 gpm pumper is no better than a 50 gpm brush truck without water. *To improve a rural ISO rating, a fire department needs to focus on developing their water supply capabilities.*

How ISO Calculates Pump Flowrate. ISO bases pump flowrate on the NFPA pump rating at 150 psi. Thus, if a pumper is rated at 1000 gpm, and the hydrant flow, tanker shuttle, or hose relay can supply 1000 gpm, the department will be credited with 1000 gpm. The department has 5 minutes after the first-due units arrive on scene to start flowing water, and then must maintain the flow *without interruption* for the required period of time. In most cases, this means being able to shift from tank water to drafting without interrupting the flow. If the department wants to shoot for a Class 7 or better rating, they have 10 minutes after they start flowing 250 gpm to increase the flowrate. If they can sustain the higher flowrate, they will be given credit for it.

How ISO Calculates Water Tank Capacity. ISO subtracts 10% (.10) of a pumper's or tanker's tank capacity to account for incomplete filling, spillage, and incomplete draining. That is, they credit only 90% (.90). Thus a 1000 gallon tank would be credited with 900 gallons. They also subtract 10% (.10) of the water contained in a drop tank to account for uneven ground and the suction limits of strainers used to draft water out of the tank.

Thus, to get the minimum of 4000 gallons of water needed for a residential Class 8 in an area where there are no water sources nearby, a pumper and/or one or more tankers with a total tank capacity of at least 4445 gallons of water need to arrive at the fire scene and pump directly onto the fire without using drop tanks (4445 gallons x .90 = 4000 gallons -- or 4000 ÷ .90 = 4445). For example, a pumper with a 1500 gallon tank and a tanker with a 3000 gallon tank would meet the requirements. More water would be required if drop tanks are used.

The only exception is the Class 9 requirement for a 300 gallon tank on a brush rig. In that case, nothing is subtracted from the tank capacity and a 300 gallon tank is all that is needed. *Keep these figures in mind when specing pumper and tanker tank capacity.*

How ISO Calculates Tanker Shuttle Flowrate. ISO uses several restrictions and procedures to calculate the water supply flowrate generated by a tanker shuttle. Refer to the articles in Where To Learn More for a more detailed description. In general, flowrate is calculated by taking 90% of each tanker's capacity divided by the total minutes it takes the tanker to load, travel, unload, and return. This gives a gallons per minute (gpm) shuttle flowrate for each tanker. The total flowrate is the sum of all tankers involved. Road speeds are limited to 35 mph during shuttle operations. Second-due/mutual-aid tankers may not arrive for a certain number of minutes after pumping starts depending on the type of response, the type of staffing, and the road distance to the fire. The required fire flow must be maintained by the first-due apparatus until the second-due/mutual-aid apparatus are allowed to arrive. This usually means the first-due apparatus must bring a lot of water.

Apparatus Age No Longer a Factor. I'm going to date myself when I tell you that I can remember when an apparatus more than 20-25 years old was not given ISO credit. This is no longer true. As long as an apparatus is in good working order, it will be given credit. Aerials should have current ladder certification and really old (or poorly maintained) pumpers may be required to pass a pump test, but otherwise age is not a factor.

This is both bad news and good news for fire apparatus manufacturers. The bad news, of course, is that departments do not have to buy new apparatus every 20-25 years as long as the old apparatus is still in good working order. The good news is that it gives apparatus manufacturers a ready market for the used apparatus they may take in trade. It also means there is a good market for rehabed/refurnished apparatus.

Specing Pumpers to Improve ISO Rural Ratings. Let's start at the low end. Many small "grass rigs" and "patrols" don't meet the requirement of a permanently mounted pump rated 50 gpm @ 150 psi for ISO Class 9. If a department is going to rely on a small brush truck for fire protection in outlying areas, they ought to get an improvement in their ISO rating for their efforts. Make sure they spec one with a pump that produces enough flowrate and pressure. Refer to the list on the next page. And while you're at it, make sure they spec at least a 300 gallon tank. Brush trucks must also have a certain amount of hose and ladders -- not enough means no Class 9 credit. Contact ISO for a list of equipment and for other requirements on personnel, organization, training, etc.

Looking ahead, maybe the department should consider a pumper that produces 200+ gpm @ 150 psi. That way, they could add a tanker and go for a Residential Class 8 rating (if it's available). In any case, if they want more than a Class 9, they should spec their rural pumpers with big water tanks. No, not 750 gallons or 1000 gallons, I mean really big tanks like 1500-2500 gallons. There is nothing sacred about single-axle pumpers. In many cases, a fully equipped pumper/tanker with 2500 gallons of water can more than pay for the cost of a tandem axle in reduced fire insurance premiums. And make sure you count only 90% of the tank capacity when trying to meet ISO rating requirements.

Other pumper specs to improve ISO ratings include a pre-connected hard suction with 6" lightweight suction hose to speed drafting time, pre-plumbed deck guns, 5" large-diameter supply hose, and large (2-1/2" minimum) tank-to-pump connections to give maximum flowrate when pumping from the tank. And don't forget the other ISO-required equipment like salvage covers, hose hoists, and hose jackets. Why should a department buy a $150,000 pumper and lose points over a $40 hose jacket?

Specing Tankers to Improve ISO Rural Ratings. Every tanker should be speced to load and unload quickly in a variety of different operations. A 500 gpm or larger pump allows self-loading, nurse tanker unloading, and direct-attack operations. The fill port and tank-to-pump connection should be 2-1/2" minimum. Tankers should also have a large dump valve and properly sized vents. Square or rectangular drop valves give much faster unloading flowrates than round. Bigger is also faster -- 10-inch square minimum, 12-inch or 14-inch is better. Side dumps allow the tanker to drive alongside a drop tank, unload, and drive off without all the time-wasting (and dangerous) backing. Side dumps should be as big as rear dumps. Unloading can be even faster with jet dumps, pressurized vacuum tanks, or even tilting tanks. All loading and unloading operations should be controlled from the cab. Ideally the driver should never have to leave the cab during any tanker operation. That includes direct-attack, where remote pump controls and a remote-controlled monitor will substantially enhance the value of a tanker.

In general, bigger tanks will result in higher water supply flowrates in ISO tanker shuttle operations where maneuverability is not a limiting factor. For example, a 3000 gallon tanker may take 6 minutes to load, 4 minutes to unload, and 4 minutes to make a 2 mile roundtrip (1 mile there and 1 mile back) at 35 mph. The ISO calculation would be (3000 x .90) ÷ (6 + 4 + 4) = 192 gpm. As a comparison, a 1500 gallon tanker may take 3 minutes to load, 2 minutes to unload, and 4 minutes to make a 2 mile roundtrip at 35 mph. The ISO calculation would be (1500 x .90) ÷ (3 + 2 + 4) = 150 gpm. Although the smaller tanker loads and unloads twice as fast as the larger tanker, it still takes the same amount of time to make the 2 mile roundtrip at 35 mph. In a sustained shuttle operation, the 3000 gallon tanker will give a higher water supply flowrate. And the greater the shuttle distance, the greater the advantage. Bigger can be better!

Engine-Driven Portable Pumps That Meet ISO Class 9 Requirement. Portable pumps are often used on brush rigs. However, not all of them meet the ISO Class 9 requirement of a minimum of 50 gpm @ 150 psi. Here are some that meet or exceed those requirements:

Manufacturer/Model	Max Flow*	Max Pressure*	Engine
CET PFP-38HP-RT	625 gpm @ 30 psi	60 gpm @ 200 psi	Gas
Darley 1-1/4AGE 11BS	60 gpm @ 130 psi	20 gpm @ 275 psi	Gas
Darley 1-1/4AGE 18BS	60 gpm @ 230 psi	20 gpm @ 360 psi	Gas
Darley 1-1/2AGE 18BS	135 gpm @ 80 psi	20 gpm @ 305 psi	Gas
Darley 1-1/2AGE 18V	125 gpm @ 125 psi	20 gpm @ 270 psi	Gas
Darley 1-1/2AGE 20V	120 gpm @ 140 psi	20 gpm @ 265 psi	Gas
Darley 1-1/2AGE 20H	120 gpm @ 140 psi	20 gpm @ 265 psi	Gas
Darley 1-1/2AGE 24 ON	180 gpm @ 95 psi	40 gpm @ 265 psi	Gas
Darley 2-1/2AGE 24 ON	310 gpm @ 45 psi	50 gpm @ 180 psi	Gas
Darley HE64RP	575 gpm @ 100 psi	165 gpm @ 250 psi	Gas
Darley 1-1/4AGE 10YD	60 gpm @ 140 psi	20 gpm @ 265 psi	Diesel
Darley 1-1/2AGE 18HD	115 gpm @ 160 psi	50 gpm @ 255 psi	Diesel
Darley 1-1/2AGE 21LD	180 gpm @ 130 psi	60 gpm @ 235 psi	Diesel
Darley 1-1/2AGE 25RD	120 gpm @ 200 psi	50 gpm @ 315 psi	Diesel
Darley 2-1/2AGE 25RD	310 gpm @ 65 psi	20 gpm @ 195 psi	Diesel
Hale HP100	160 gpm @ 50 psi	40 gpm @ 250 psi	Gas
Hale HP100F	135 gpm @ 50 psi	30 gpm @ 300 psi	Gas
Hale HP200	230 gpm @ 50 psi	40 gpm @ 160 psi	Gas
Hale HP550	530 gpm @ 50 psi	40 gpm @ 270 psi	Gas
Hale 20FD-A33	80 gpm @ 50 psi	25 gpm @ 300 psi	Diesel
Hale HP100-L53	145 gpm @ 50 psi	25 gpm @ 260 psi	Diesel
Mallory M90	130 gpm @ 75 psi	30 gpm @ 300 psi	Gas
Robwen 125	75 gpm @ 90 psi	10 gpm @ 235 psi	Gas
Robwen 180	110 gpm @ 100 psi	10 gpm @ 250 psi	Gas
Wajax 200VG	160 gpm @ 90 psi	50 gpm @ 170 psi	Gas
Wajax 200D	160 gpm @ 90 psi	50 gpm @ 170 psi	Diesel
Wajax 300VG	105 gpm @ 100 psi	36 gpm @ 350 psi	Gas
Wajax 300D	105 gpm @ 100 psi	36 gpm @ 350 psi	Diesel
Wajax 400	360 gpm @ 50 psi	60 gpm @ 200 psi	Gas
Waterous PB11-G1510B	70 gpm @ 100 psi	10 gpm @ 300 psi	Gas
Waterous PB18-2515B	200 gpm @ 25 psi	75 gpm @ 150 psi	Gas
Waterous PB18-G2015B	75 gpm @ 170 psi	20 gpm @ 370 psi	Gas
Wildfire Pacific BB-4	110 gpm @ 50 psi	15 gpm @ 400 psi	Gas
Wildfire Pacific BB4-D	101 gpm @ 50 psi	12 gpm @ 400 psi	Diesel
Wildfire Pacific BB4-KD	115 gpm @ 50 psi	20 gpm @ 400 psi	Diesel

* All ratings are approximate. Contact the manufacturer for pump curves and certification.
The ISO does not approve or endorse any particular pump model.

ISO's Community Outreach Program. ISO is reaching out to communities and fire districts to identify changes that may improve the ISO rating for the area. They plan to contact every community over the next 30 months (and every 30 months thereafter) for information on any significant changes, and, when required, schedule field surveys. Changes might include district boundaries, station locations, automatic aid agreements, number and type of apparatus, and others. For further information on this program, call ISO at (800) 444-4554.

Where To Learn More. ISO publishes The Fire Suppression Rating Schedule, which contains the legal language and mathematical formulas behind the ratings. For information call ISO at (800) 930-1677.

Several fire service magazines have also featured articles on ISO rural ratings. Most of the information in these articles is accurate, but some points in some articles are in error. *None of the articles has been reviewed or endorsed by the ISO.* Here are a few you can use for general reference:

"Rural Water Supplies," Fire Rescue, February 1998, pp. 80-81. [This is a good presentation of what it takes to meet ISO rural water supply requirements. The statement that 250 gpm for 2 hours earns a Class 7 is in error. It is a benchmark for a Class 8 or better.]

"A Tale of Two Ratings, Part 2: The Rural Rating," Fire Rescue, March 1998, pp. 55-59. [This article describes how the Fallon/Churchill (NV) VFD earned an ISO Class 2 rural rating.]

"Filling the Vacuum," Fire Rescue, March 1998, pp. 62-68. [Part 1 details how Wayne County (OH) used a dry hydrant to fill tankers as part of an ISO shuttle operation.]

"Back to Ohio," Fire Rescue, April 1998, pp. 62-68. [Part 2 shows how Wayne County (OH) dumped their tankers as part of an ISO shuttle operation. The figures in the Total Time column on p. 67 are wrong. They should be the sum of Travel Time and Turn Around.]

"Improving Water Supply in Nonhydrant Areas: One Department's Approach," Fire Engineering, April 1998, pp. 109-118. [Anne Arundel County (MD) investigated a variety of methods to improve their ISO rural rating. Tanker 1 capacity in Table 3 should be 3,000.]

"Credit by Demonstration," Fire Rescue, April 1998, pp. 83-85. [This article discusses some of the problems and limitations departments may encounter in meeting ISO rural water supply requirements. It also has a good illustration of how ISO measures time for shuttles and relays.]

"How to Get $7.1 Million," Fire Rescue, May 1998, pp.46-57. [This article details the political/public relations efforts it took for the Animas (CO) Fire District to translate potential reduced fire insurance premiums from a lowered ISO rating into a $7.1 million bond for new apparatus, equipment, and stations.]