GUIDE

TO TRUCK SELECTION FOR SPECIAL APPLICATIONS

POWER-DRIVEN EQUIPMENT

BEVERAGE BODIES

CONCRETE MIXERS

FIRE-FIGHTING EQUIPMENT

DUMP BODIES

TRACTOR EQUIPMENT

VAN-PANELS

TANK BODIES

REFUSE COLLECTION BODIES

WINCHES AND CRANES

SNOW PLOWS

CHEVROLET

FOREWORD

This book is intended to serve as a guide in selecting and recommending the correct truck model and optional equipment for use with the following special body types and vocational equipment:

Power Take-Offs
Beverage Bodies
Concrete Mixers
Fire Fighting Apparatus
Dump Bodies, Underbody Hoists and Hydraulic Lift Gates
Tractor Equipment
Van Panel Bodies
Tank Bodies
Refuse Collection Bodies
Winches and Cranes
Snow Plows

Also included is a Glossary of Trucking Terms in common use throughout the industry.

The information given in the Truck Data Book on load distribution and truck selection is based on general applications where it is assumed that the payload will be evenly distributed, and that there are no restrictions on overhang and no concentration or shifting of weight during normal operations. Many types of bodies and special equipment, most of which are covered in this book, do not fall into this general category and, therefore, require that special consideration be given to various factors and components to tailor the truck satisfactorily for the work to be done.

This book is intended as a guide only. The recommendations of the supplier of the special equipment to be installed should be obtained before a firm price is quoted to the customer and the truck is ordered from your Zone Office.

Chevrolet Motor Division makes every effort to keep dealers and salesmen informed as to where all known types of truck equipment can be obtained. This is done by distributing the Silver Book to dealers on a yearly basis although the Silver Book is *not* a Chevrolet publication. Also, literature on various types and makes of truck equipment is distributed to dealers as it becomes available.

In making such distribution, Chevrolet Motor Division has no interest in or connection with the manufacture or distribution of such equipment, and does not endorse or assume any responsibility with respect to it or any other equipment of its type.

The Silver Book and any literature covering equipment supplied by sources other than Chevrolet Motor Division is distributed to dealers and prospective retail purchasers only as a matter of information.

SPECIAL EQUIPMENT APPLICATIONS

GENERAL

Before attempting to establish the specifications and quote a price on *any truck deal*, all possible information should be obtained from the prospect as to its intended use. The minimum information should consist of the following:

1. Type of cargo—case goods, perishables, live stock, bales, drums, bulk goods, liquids, shifting loads, etc.
2. Size of cargo—length, width, height, cubic volume, etc.
3. Weight of cargo—include payload, body and/or special equipment.
4. Type of Road—all highway, off highway, on and off highway, level terrain, hilly terrain, maximum grade, etc.
5. Type of Operation—full load both ways, empty one way, diminishing load, frequent stops, use of truck engine for auxiliary power operated equipment, maximum speed desired, etc.
6. Possible Limitations—height of doors where truck is to be stored, loading dock heights, ice and snow conditions.
7. Legal Requirements—I.C.C., state or local limitations where truck will be licensed and operated.
8. Trailed Equipment type—Round vs. square-nose trailers, back-of-cab auxiliary equipment, etc., influencing CA dimension required on tractor.

POWER TAKE-OFFS

Because there are so many different types of bodies and equipment which require power take-offs of one type or another, this section covers general information relating to power requirements and the best method of filling them.

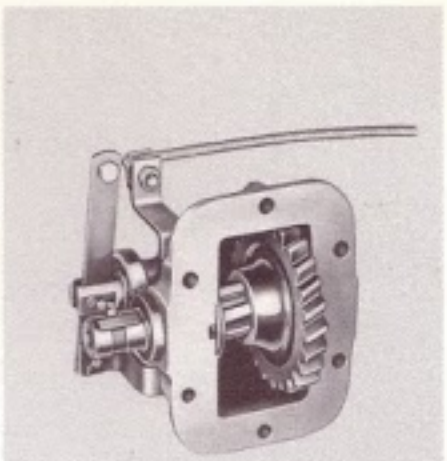
In determining the type, size and location of the power take-off to be used, the following information should first be obtained.

1. What kind of equipment? Hydraulic pump, winch, air compressor, feed grinder, fire apparatus, etc.
2. RPM required by the unit to be driven?
3. Horsepower required to drive the unit involved?
4. Does operation require single-speed forward and reverse, two speeds forward and reverse?
5. Is the rotation of the unit to be driven the same as that of the truck engine or opposite?

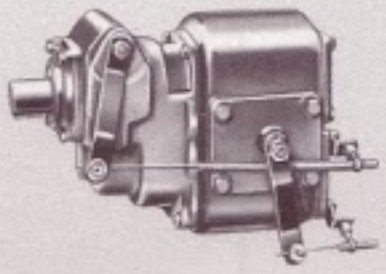
With the above information, the type and size of power take-off can be determined, which will dictate the transmission and/or auxiliary transmission with which the truck should be equipped. For some light-duty equipment such as snow plows, underbody hoists, sweepers and hydraulic lift gates commonly installed on ½-, ¾-, and 1-ton trucks, the hydraulic equipment may be driven by the fan belt or electrically. In such cases, it is not necessary that the transmission have a power take-off opening.

The transfer case on four-wheel drive models has an opening for a full torque power take-off. However, unless full power is required for driving such items as post hole diggers, saws, trenchers, or other highly specialized equipment, it is much more economical to supply a four-speed transmission which has a PTO opening and a side mounted power take-off.

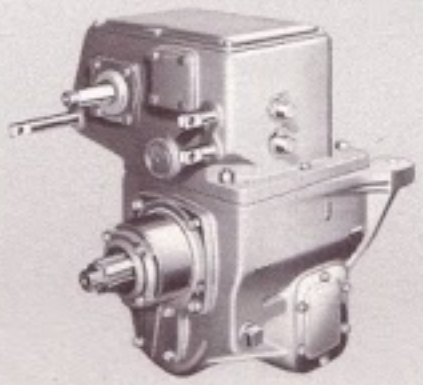
The table on the following pages indicates the power take-offs most commonly used with various equipment, and the PTO output requirements of the transmissions with which they can be used.



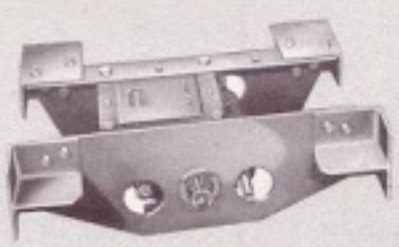
SINGLE-SPEED ONE-GEAR POWER TAKE-OFF
(Spicer Model AAN)



MULTI-SPEED POWER TAKE-OFF
Two-speed forward, two-speed reverse (Chelsea Model 56A)



TOP-MOUNTED POWER TAKE-OFF
One-speed forward, one-speed reverse (Spicer Model 310535X, shown mounted on 4-speed auxiliary transmission)



SPLIT-SHAFT POWER TAKE-OFF
Full engine power at all speeds of truck transmission, reversing and dual output models available (Gar Wood Model L)

CHEVROLET TRUCK TRANSMISSIONS FOR PTO APPLICATIONS

TRANSMISSION	OUTPUT TO PTO*
Chevrolet 4-Speed	559 ft./min.
Clark 264VO, 267V & 267VO	
Left side	369 ft./min.
Right side (with adapter)	481 ft./min.
Clark 265V	
Left side	369 ft./min.
Right side (with adapter)	481 ft./min.
New Process 540	
Left side	244 ft./min.
Right side	398 ft./min.
Spicer 3152	
Right & Left side	401 ft./min.
Spicer 3152A & 3153	
Left side	505 ft./min.
Right side	506 ft./min.
Spicer 5756B	
Right & Left side	465 ft./min.
Spicer 5652B	
Right & Left side	427 ft./min.
Fuller R46	
Right & Left side	1084 ft./min.
Allison MT Series (Powermatic)	
Neutral, First, Third, Fifth & Reverse	1791 ft./min.
Second, Fourth & Sixth	2487 ft./min.
Spicer 5831 (Auxiliary)	
Main Trans. in Direct...100:1,	1315 ft./min.
Spicer 6041 (Auxiliary)	862 ft./min.

**Transmission PTO driver gear pitch line velocity at 1000 engine rpm.*

POWER TAKE-OFF APPLICATIONS

TYPE OF EQUIPMENT	TYPE OF PTO REQUIRED	TRANSMISSION REQUIREMENTS*
AERIAL LADDERS & PLATFORMS—	Light or medium duty, single-speed, single gear or 2-gear	Minimum of 400 FPM
AIR COMPRESSORS— Small—Capacity up to 85 cu. ft. per minute Large—Capacity 85 cu. ft. per minute or larger	2-gear, H.D., single-speed 6-bolt Single-speed 8-bolt Split shaft	Minimum of 500 FPM Trans. with 8-bolt PTO opening Any transmission
BLOWERS— Bulk Cement	Extra H.D., single-speed 6-bolt (marginal applications) Suggest 8-bolt, single-speed or split shaft	Minimum of 1000 FPM Trans. with 8-bolt PTO opening Any transmission
CONCRETE MIXERS— Small Medium and Large	Extra H.D., single-speed 6-bolt Flywheel PTO or 8-bolt single-speed	Minimum of 1500 FPM Trans. with 8-bolt PTO opening
DUMP BODIES—HYDRAULIC Small—Capacity up to 8 cu. yds. Medium—Capacity 10 yds. Large—Capacity 12 to 18 yds. Extra large—Capacity 20 yds. or over	Single gear, light or medium duty single gear, H.D. or 2-gear H.D. PTO 2-gear extra H.D. PTO 8-bolt PTO	Minimum of 400 FPM Minimum of 500 FPM Minimum of 500 FPM Trans. with 8-bolt PTO opening
DUMP BODIES—CABLE	H.D. Reversible PTO	Minimum of 500 FPM
FIRE ENGINES— Auxiliary Pump Main Pump	Extra H.D. PTO Split Shaft or 8-bolt PTO	Minimum of 550 FPM Any transmission Trans. with 8-bolt PTO opening
GARBAGE BODIES—HYDRAULIC Small Large	Extra H.D., 2-gear PTO 8-bolt PTO	Minimum of 550 FPM Trans. with 8-bolt PTO opening
GARBAGE BODIES—MECHANICAL Small Large	H.D. Reversible Reversible 8-bolt PTO or Split Shaft	Minimum of 500 FPM Trans. with 8-bolt PTO opening Any transmission
GENERATORS— Small Electrical Power Units Large for Welding	2-gear, H.D. or extra H.D. Split Shaft or 8-bolt PTO	Minimum of 500 FPM Any transmission Trans. with 8-bolt PTO opening

**(PTO driver gear pitch-line velocity in FPM at 1000 engine RPM or as specified)*

POWER TAKE-OFF APPLICATIONS

TYPE OF EQUIPMENT	TYPE OF PTO REQUIRED	TRANSMISSION REQUIREMENTS*
POST HOLE DIGGERS—HYDRAULIC		
Small	Extra H.D., 2-gear PTO	Minimum of 600 FPM
Large	8-bolt PTO or Split Shaft	Trans. with 8-bolt PTO opening Any transmission
POST HOLE DIGGERS—MECHANICAL	H.D. Reversible	Minimum of 500 FPM
PUMPS—HYDRAULIC		
Capacity based on 1000 RPM, 1000 PSI		
Up to 15 gals. per min.	Light or medium duty, Single gear PTO	Minimum of 400 FPM
Up to 25 gals. per min.	2-gear, H.D.	Minimum of 500 FPM
Up to 35 gals. per min.	2-gear, extra H.D. PTO	Minimum of 800 FPM
36 gals. or higher	8-bolt PTO or Split Shaft	Trans. with 8-bolt PTO opening Any transmission
PUMPS—TRANSFER		
Capacity based on 500 RPM, 50 PSI		
Gasoline, Oil & Fuel Oil		
0 to 150 gals. per min.	H.D., 2-gear	Minimum of 500 FPM
150 to 300 gals. per min.	Extra H.D., 2-gear PTO	Minimum of 800 FPM
300 up or Aircraft Refuelers	8-bolt PTO or Split Shaft	Trans. with 8-bolt opening Any transmission
Asphalt Pumps	Extra H.D., 2-gear PTO 8-bolt PTO or Split Shaft	Minimum of 800 FPM Trans. with 8-bolt opening Any transmission
SNOW PLOWS—	Recommend Front Engine Drive or 2-gear, H.D. single speed	Minimum of 500 FPM
SPREADERS—MECHANICAL		
Lime Fertilizer	Single-speed H.D. 2-gear PTO with 2-speed gear box or 2-speed H.D. PTO	Minimum of 500 FPM
SPREADERS—HYDRAULIC	Front Engine or 2-gear, single-speed H.D. PTO	
TAILGATES—	Single gear, med. duty	Minimum of 400 FPM
WINCHES—MECHANICAL		
Under 25000# capacity	H.D. Reversible PTO	Minimum of 500 FPM Maximum of 2000 FPM
Over 25000# capacity	8-bolt Reversible Top Mount (Power Dome) or Split Shaft	Trans. with 8-bolt PTO opening Auxiliary with top mount opening Any transmission
WRECKERS—See Winches		

(PTO driver gear pitch-line velocity in FPM at 1000 engine RPM or as specified)

BEVERAGE BODIES

Chassis and cab models for the installation of beverage bodies require unusual consideration in making recommendations for the standard components and optional equipment because of the following abnormal conditions:

1. Bottlers' trucks are always loaded to at least 75% of their capacity and a major portion of the time they are carrying a full load. This results from the fact that when cases of full bottles are delivered, cases of empty bottles are reloaded on the truck. The liquid represents only 25% of the total weight. Quite often full cases are loaded on the truck when it returns from the route and stay on the truck until the next route delivery is started.
2. Wheelbases are altered more often than not to accommodate a certain number of cases ahead of the wheelhousings over the rear wheels. This is usually done when the frames are dropped or pinched to provide low loading height for the pallets, and accessibility for unloading. Therefore, the weight distribution cannot be calculated on the wheelbase of the truck, as delivered from the assembly plant, but must be calculated on the length of the wheelbase after it is altered. (Check compatibility of chassis equipment when transferring or installing bodies on new model trucks.)
3. With the variety of bottle sizes now available, there is no pattern of unloading from the rear of the truck first and working the load forward. All cases may be unloaded from the front bays first, thus leaving a very high percentage of the load on the rear axle or vise versa.
4. Frequent stops result in more than ordinary wear on brakes and clutches.
5. Some trucks purchased and designed for pallet loading with fork trucks are often hand loaded. This results in approximately 25% more payload because the space normally taken up by the pallets is loaded with cases. This can result in an extreme overload so it should always be determined if the truck is ever to be hand loaded.

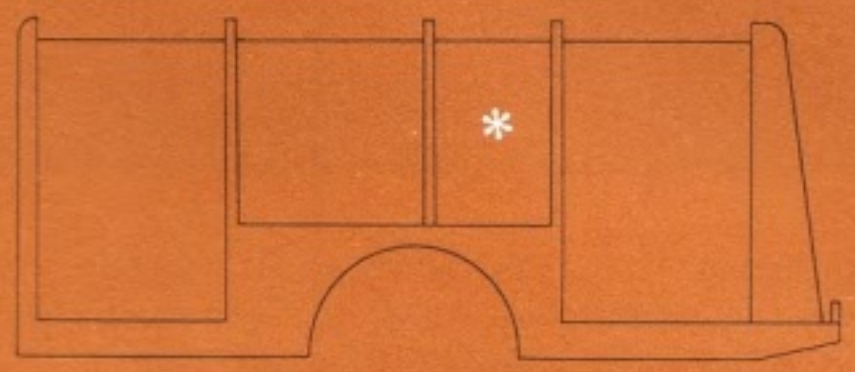
In view of the above unusual conditions encountered with beverage bodies, it is always well to recommend the following:

1. Front axle, springs, and tires with a capacity of at least 20% above that required to carry the weight calculated for the front axle when the truck is fully and evenly loaded.
2. Heaviest rear and auxiliary rear springs available for the rear axle necessary to carry the load because of the side sway and the possibility of loading full pallets on one side of the truck before the other side is loaded. Otherwise the body may be down on the tires on one side.
3. Heaviest available clutch for the engine involved and brakes for the axles involved. Vacuum power or air brakes are recommended for the larger capacity trucks.

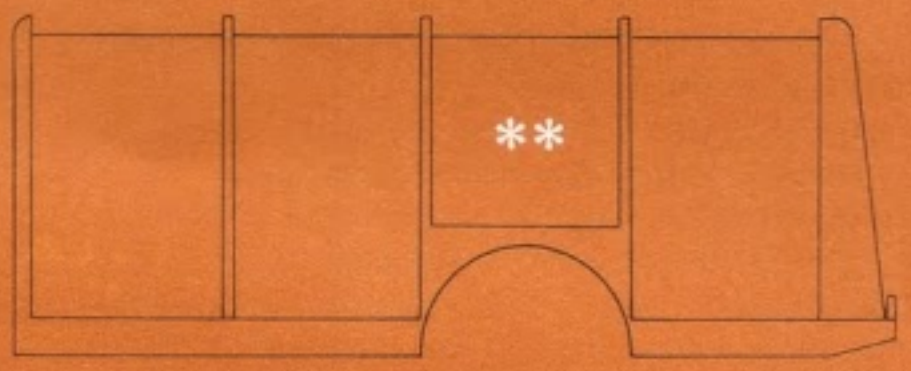
The following sketches show some of the most common types of beverage bodies now in use for pallet loading. The bay marked "empty" is usually called a "starter bay." This is to provide space for empty cases which may be picked up on the first few deliveries and exceed the number of full cases delivered.

CHASSIS CA AND GVW REQUIREMENTS FOR VARIOUS STANDARD BEVERAGE BODY SIZES:

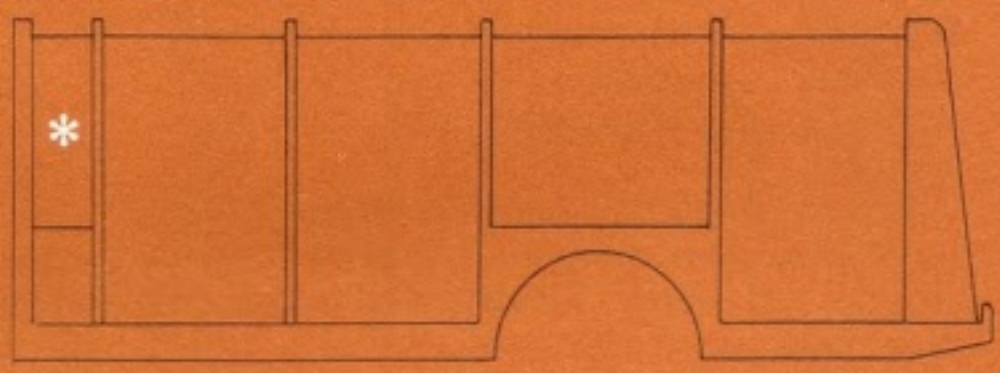
11 cases long—84" CA—18000 lbs. GVW
Case capacity—288 6-oz.
192 10-oz.



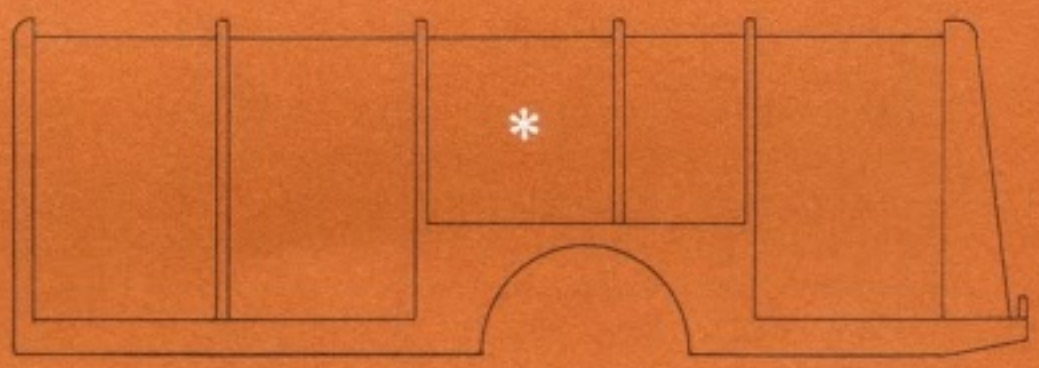
12 cases long—102" CA—19500 lbs. GVW
Case capacity—282 6-oz.
240 10-oz.



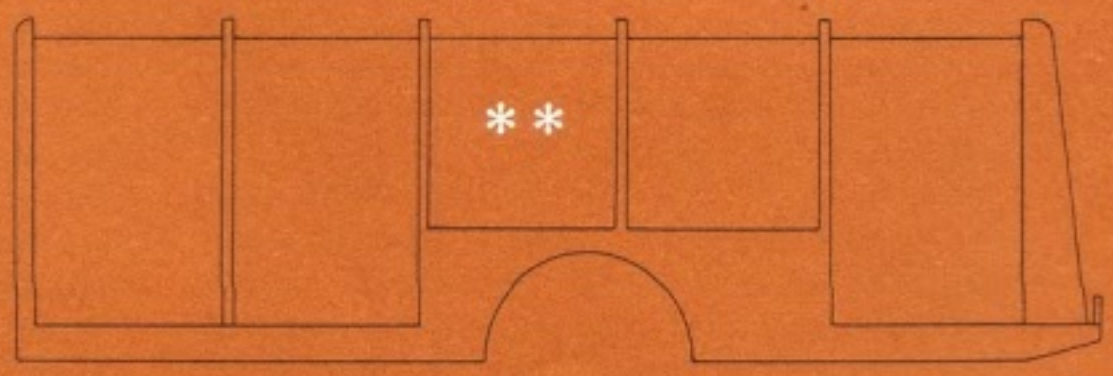
13 & 13½ cases long—120 to 126" CA—22000 lbs. GVW
Case capacity—312 6-oz.
264 10-oz.



14 cases long—120 to 124" CA—22000 lbs. GVW
Case capacity—312 6-oz.
264 10-oz.



15 cases long—120 to 124" CA—25000 lbs. GVW
Case capacity—342 6-oz.
288 10-oz.



**Capacity figured with this bay empty both sides.*
***Capacity figured with this bay empty one side.*

CONCRETE MIXERS

This highly specialized type of equipment requires careful consideration of the power required by the mixer as well as of the capacities of the load-carrying components required for the tremendous weight involved.

For power to operate the mixer, the following different methods are used.

1. Separate engine drive. An auxiliary engine is supplied as part of the mixer equipment.
2. Front-of-engine drive. In this method, a take-off is attached to the front of the crankshaft on the truck engine. Power is then transmitted back to the mixer transmission by a drive shaft, "U" joints, hanger bearings, etc. These drive shafts may be either solid or tubular and may run outside the frame side rail, usually on the right side, or they may be located inside the frame rails, depending upon the location of the mixer transmission.

   Tubular shafts and inside-the-frame location present the greater problems because of cross-member and engine support interference, cab floor clearance, exhaust pipes, etc.

   A front-of-engine take-off cannot be installed on truck engines where the fan, water pump or other items interfere with the front of the crankshaft. In some cases, the woodruff keys or splines at the front of the crankshaft do not have sufficient capacity to transmit the full power of the engine. Therefore, *always determine from the Zone Office whether or not a front-of-engine take-off is available for the truck engine being considered.*
3. Flywheel Power Take-Off. In this method, a separate cluster of gears enclosed in a housing is attached to the bellhousing of the truck engine between the truck engine and the clutchhousing. From a projection on the PTO housing, a shaft extends rearward. This is connected by a drive line to the mixer transmission.

   At present, flywheel take-offs are available only for engines having the SAE No. 2 bellhousing. Also, the projection from the take-off housing extends so far above the truck frame that cab floor interference is encountered. *Availability and installation possibilities should always be ascertained from the Zone Office on the exact truck model being considered.*
4. Power Dome or Top Mounted Take-Off. This method is available for certain models having auxiliary transmissions with top PTO openings. While high power output is possible, applications are limited because of drum speed control problems caused by variations in road speed as the truck is driven.
5. Regular side-mounted transmission take-offs. On some types of smaller capacity mixers, this method of driving is satisfactory. However, it is very limited because of lack of sufficient power and the drum speed control problem resulting from changes in engine speed as the truck is driven.

Always ascertain from the mixer manufacturer the type of engine, transmission and auxiliary required by the mixer to be installed.

For economical reasons, most concrete mixer operators desire to take full advantage of the axle carrying capacities permitted under state and local highway load limit laws. Therefore, they attempt to purchase mixers and have them so installed that the percentage of the load carried on the front axle approaches the maximum load limit allowed.

All mixer manufacturers can advise you the weights of their mixer and payload which will be on the front axle and the rear axle or tandem bogie if they have the CA and wheelbase of the chassis involved. With this weight information, the proper axles, springs and tires can be recommended.

As a general rule, the heaviest front axle, springs and tires available for the truck model being considered, along with power steering, are recommended. Caution should be exercised in selling chassis that do not have sufficient axle capacities for the mixer to be installed.

Many special equipment suppliers can now furnish tag or pusher axles on tandem models, which increases the carrying capacity of standard models and permits the operators to use larger mixers and still stay within the axle load laws. The mixer supplier should be consulted before recommending such conversions to assure there is no conflict with the mixer equipment installation.

Although selling a truck for the installation of a concrete mixer may appear to be complicated, no salesman should overlook the possibility of a very profitable sale. Usually a telephone call to the manufacturer of the mixer preferred by the prospective customer will make it very simple.


CHEVROLET

FIRE FIGHTING APPARATUS

The specifications for motor trucks to be used as Motor Fire Apparatus are more or less under control of the National Board of Fire Underwriters, recommended by the National Fire Protection Association, and approved by the International Association of Fire Chiefs. Certain tests must be conducted by the fire apparatus manufacturer before a unit is delivered, and certified test data must be submitted to the National Board of Fire Underwriters. Upon delivery, both road and pumping acceptance tests of at least three hours' duration are also made. If all tests do not meet the requirements, the apparatus cannot be accepted.

Since the apparatus manufacturer is responsible for complying with the requirements and since the apparatus is usually much more costly than the chassis on which it is installed, it is understandable that fire apparatus manufacturers are very exacting in the recommendation of chassis. They must be sure the chassis has adequate power for operating their pumper equipment and carrying capacity for the load involved.

Some of the more important specifications applicable to chassis, as established by the above Board, are:

"1. The fully laden weight of the completed vehicle, including the filled water tank, full complement of hose and equipment, and equivalent personnel loading of 1200 pounds, shall not exceed the chassis manufacturer's GVW rating for the model. In any event, the total load on each axle shall not exceed the rating of the axle manufacturer nor exceed the axle loads permitted under applicable state laws.

Note: (1) Actual weighing of apparatus to determine compliance with these provisions is recommended.

(2) The chassis manufacturer may be required to furnish published or properly certified data covering GVW and axle ratings.

(3) When selecting chassis for fire apparatus, it is recommended that optional heavy-duty axle equipment available from chassis manufacturers be specified when necessary to meet the requirements of this section.

2. Each load bearing tire of the apparatus shall not carry a weight greater than 10 per cent in excess of the recommended load for truck tires in highway service, of the size used, as published by the Tire and Rim Association, Inc., Akron, Ohio.
3. From a standing start through the gears the vehicle shall attain a true speed of 35 mph within 30 seconds. If the purchaser so desires, this test shall be met by traveling a distance of 770 feet in 30 seconds beginning from a standing start.

From a steady speed of 15 mph in direct drive, the vehicle shall accelerate to a speed of 35 mph within 30 seconds.

The vehicle shall attain a top speed of not less than 50 mph. The vehicle shall demonstrate ability of the parking brake to hold the vehicle in position on a 20 per cent grade, or the maximum grade in the City when specified, while performing any designed stationary functions.

The ability of the braking system shall be demonstrated by bringing the vehicle to a complete stop from an initial speed of 20 miles per hour in a distance not exceeding 30 feet by actual measurement on a hard-surfaced road that is substantially free from loose material, oil or grease.

4. The engine shall be capable of performing the pumping tests herein specified without exceeding the governed speed of the engine as shown on a certified brake horsepower curve of the type of engine used without accessories; the certification to be by a responsible official of the engine manufacturer.

The engine shall demonstrate its ability to deliver 10 per cent more power than required to pump rated capacity at rated pressure. This shall be done without exceeding the certified governed speed of the engine.

5. The purchaser must specify, in Special Provisions, if the pump is to be expected to deliver rated capacity and pressure at an elevation of over 1,000 feet.
6. An engine governor shall be installed which will limit the speed of the engine under all conditions of operation to that speed established by the engine manufacturer; this will be the maximum no-load rpm.
7. The cooling system of the engine shall be adequate to maintain a temperature of the cooling water in the engine not in excess of 185° F.
8. Battery capacity shall be commensurate with the size of the engine and the anticipated electrical load. Capacity shall not be less than 150 ampere-hour rating at a 20-hour discharge rate for 6-volt potential, or 120 ampere-hour rating at a 20-hour discharge rate for a 12-volt system. When a dual battery system is supplied, each battery shall be of the capacity required for a single battery system. A polarized receptacle shall be provided for auxiliary charging connection to each battery."

To meet the above requirements from a pumper capacity standpoint, the following current Chevrolet engines are normally required:

PUMPER CAPACITY	TYPE OF PUMPER	ENGINE REQUIRED
500 Gallons Per Minute	Mid-Ship	292 or 327
750 Gallons Per Minute	Mid-Ship	327 or 348
1000 Gallons Per Minute	Mid-Ship	409*

*Not all makes of pumpers will deliver 1000 gpm with the 409 engine. Therefore, the assurance of the pumper manufacturer should be obtained before selling a truck for a 1000 gpm pumper.

From a weight carrying standpoint, trucks with GVW ratings as listed below should be recommended for apparatus with various sizes of booster tanks.

BOOSTER TANK SIZE	CHASSIS GVW RECOMMENDED
500 Gallons	19500
600 Gallons	19500
700 Gallons	21000
800 Gallons	22000
900 Gallons	25000
1000 Gallons	25000*

*Because of load distribution, it is sometimes necessary to order COPO 23,000 lb. rear axle to meet this requirement. *Exact weight on each axle should be obtained from apparatus manufacturer before making recommendation or quoting price.*

Some unusual factors may often have to be considered in recommending chassis for fire fighting apparatus. Some of the most common ones are:

1. Altitude at which apparatus is to be operated. May require larger engine capacity than at lower altitudes.
2. Is high pressure system, requiring high speed transmission-mounted power take-off, included in apparatus?

Generally, the optional or special COPO equipment listed below should be recommended in making proposals for Motor Fire Apparatus.

Extra capacity gasoline tanks
Auxiliary electric fuel pumps
100 amp. alternating current generator
Heavy-duty front axle
Heavy-duty springs

As with concrete mixers, do not walk away from a fire apparatus deal. A telephone call to the apparatus manufacturer can develop into a very profitable and prestige-building sale.

Often items such as 150 amp. batteries, large capacity gas tanks, and the electric fuel pumps can be more readily supplied by the apparatus manufacturer. This possibility should be investigated.

DUMP BODIES, *Underbody Hoists and Hydraulic Lift Gates*

The overhang on most dump body applications is less than usually considered normal for platforms, stakes, vans, etc. This is desirable to provide sufficient height from the floor of the body to the ground when the body is dumped to allow the material to flow out freely.

This shorter overhang results in a higher percentage of the load being carried on the front axle. Also, it is common practice in dump truck operation to heap the load somewhat higher at the front of the body, shifting the load center still farther forward. However, when the load is dumped, a transfer of the center of gravity occurs which often places the entire weight of the payload and body on the rear axle and tires.

Therefore, the capacity of the axles and springs, both front and rear, must be greater than those used for a comparable payload with a stationary body. The front axle and springs should have a capacity equal to the load carried on them when the body is in normal running position. The rear axle, springs, and tires should have a capacity equal to 75% of the total weight of the body and payload because the body normally is in dumping position only a relatively small percentage of time. There are cases when the truck is to be used for spreading that the body will be in dumping position a relatively high percentage of time. In these cases, the rear axle, springs, and tires should have capacities nearing the total weight of body and payload to give maximum service and durability.

In addition to the above characteristics of dump body operation, the shock loads imposed by dumping and often by loading from a shovel or tipple creates greater strain on the frames than ordinary truck uses. Therefore, the maximum frame reinforcements are recommended for all dump truck operations.

It should always be ascertained if the body is to be equipped with a cab protector and if a portion of the payload is to be carried on the cab protector to take advantage of some state axle loading laws. This factor should be taken into consideration in computing the weight distribution to determine the capacity of the front axle, springs, and tires.

The following material will be of assistance in figuring the great majority of dump truck deals:

The table below gives the weight, per cubic yard or other standard unit, of most commodities usually hauled in dump bodies.

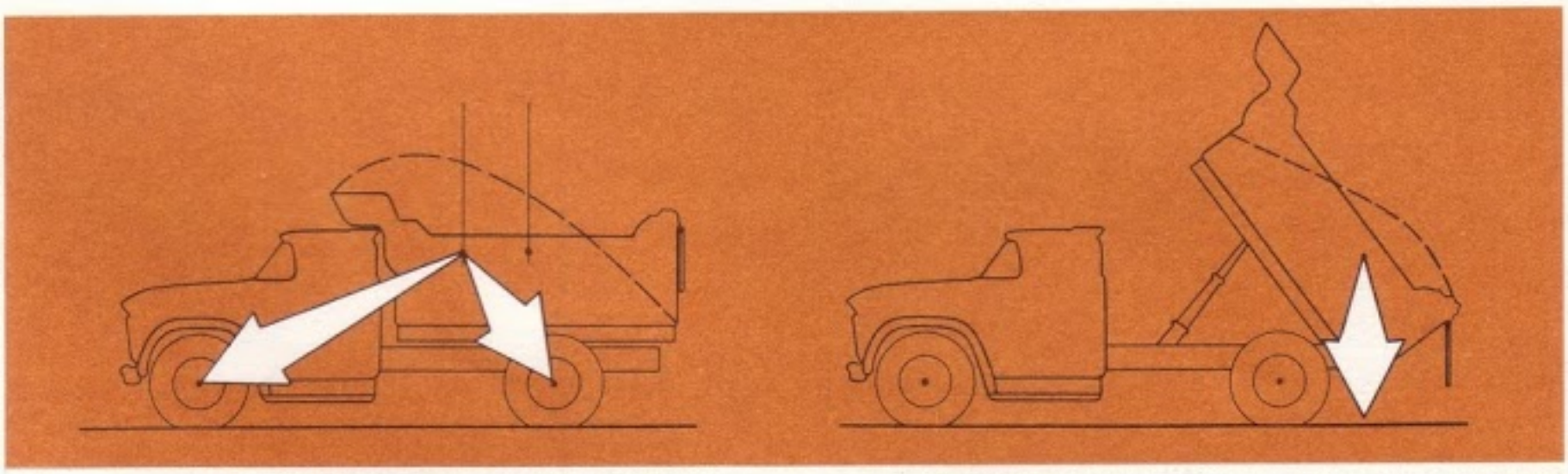
Chart #1 on the following pages will enable you to determine, for various body lengths, CA's and wheelbases, the percentage of body and payload weight to be carried on the front axle when the load is uniformly distributed over the length of the body. Where normal loading practices result in a substantial forward weight shift, reading the chart for a shorter body size will give a more realistic value for front axle loading.

Chart #2 shows the height of the sides of the body necessary to accommodate a specified number of cubic yards when the length and width of the body desired are known.

With this information, the size of a body required to haul a specified quantity of most commodities can be determined. The wheelbase and CA dimension of the truck most suitable can also be determined. Then the weight distribution can be calculated and the proper axles, springs, and tires can be recommended.

Caution is advised when ordering the dump body to be sure that it will be equipped with a sub frame which will be mounted between dump body and chassis frame. Dump bodies *must never* be mounted directly on chassis frame.

Underbody Hoists fall into the same general category as dump bodies. These hoists are commonly installed under stake or platform bodies, combination stock and grain bodies, and standard pickup boxes. The power take-off drive is the same as for dump bodies, but the weight distribution is usually more near that of a normal body installation because the



Extreme forward weight distribution when load is carried on cab protector.

Rearward weight shift in dumping can put entire body and payload weight behind rear axle.

overhang of the body is usually not reduced. A heavy-duty or reinforced frame is recommended with underbody hoists, and the rear axle, springs, and tire capacity should be at least 75% of the total weight of the hoist, body and payload.

Hydraulic Lift Gates also fall into the same general category as hydraulic hoists, insofar as the drive is concerned. However, they present an entirely different weight distribution problem. Since practically the entire weight of the gate and lifting mechanism is at the extreme rear end of the body and well behind the centerline of the rear axle, the weight of the gate and lifting mechanism should not be included with the weight of the body and payload in calculating load distribution. Rather, the weight of the gate should be added separately to the load to be carried on the rear axle. These gates often have a capacity of several thousand pounds. Therefore, it is very important to know the amount to be lifted with the gate, and to add this amount in determining the capacity required for the rear springs. This should also be considered in rear axle and rear tire selection, but since it is an intermittent use, the axle and tire capacity usually needed is only about 75% of the total load of the body, lift gate and payload to be lifted to give satisfactory service.

GUIDE TO WEIGHTS OF MATERIALS (Approximate)

	Lbs. per Cu. Ft.	Lbs. per .... Unit	
Asbestos	125-175	3370-4725	cubic yard
Ashes, Hard Coal	26-37	700-1000	cubic yard
Ashes, Soft Coal with Clinkers	37-56	1000-1515	cubic yard
Ashes, Ordinary Soft Coal	40-45	1080-1215	cubic yard
Asphalt, Mixed Paving	100	2700	cubic yard
Barley	39	48	bushel
Beets	44-48	55-60	bushel
Bluestone	147	2970	cubic yard
Bone	106-125	2860-3380	cubic yard
Borax	109	2943	cubic yard
Brick, Hard Clay, 2½ x 4 x 8¼"	125	3397	cubic yard
Brick, Hard Clay, 2½ x 4 x 8¼"		6.4	each
Cement, Portland		2430	cubic yard
Chalk	118-175	3180-4725	cubic yard
Cinders	40-52	1080-1404	cubic yard
Clay, Wet	110	2970	cubic yard
Clay and Gravel, Dry	100	2700	cubic yard
Coal, Anthracite, Nut	52	1536	cubic yard
Coal, Bituminous, Pocahontas Egg and Lump	52	1411	cubic yard
Concrete	120-155	3240-4180	cubic yard
Copper Ore	262	7065	cubic yard
Corn, in Ear	56	70	bushel
Corn, Shelled	45	56	bushel
Earth, Damp, Loose	78-100	2100-2700	cubic yard
Earth and Sand, Wet	120	3240	cubic yard
Garbage, Dry (Paper Wrapped)	9.3-15	250-400	cubic yard
Garbage, Wet	41-52	1100-1400	cubic yard
Granite	160-175	4320-4725	cubic yard
Gravel	100-120	2700-3240	cubic yard
Hay in Bales	20		
Limestone, Crushed	96	2590	cubic yard
Malt	28	35	bushel
Meal	40	50	bushel
Mortar, Rubble, Dry	138	3730	cubic yard
Mud, Wet (Moderately Packed)	110-130	2970-3510	cubic yard
Oats	25.7	32	bushel
Potatoes, Sweet		55	bushel
Potatoes, White or Irish		60	bushel
Quartz	163-168	4400-4540	cubic yard
Rock and Stone	85-104	2295-2810	cubic yard
Rye		56	bushel
Sand, Dry, Loose	90-106	2430-2860	cubic yard
Sand, Wet	118-129	3185-3485	cubic yard
Sandstone	140-167	3780-4510	cubic yard
Shale	162-172	4370-4645	cubic yard
Silica	133-142	3590-3840	cubic yard
Slate	170-205	4590-5550	cubic yard
Sugar	55		
Sulphur	125	3375	cubic yard
Tar	62-75	1675-2025	cubic yard
Wheat		60	bushel

CHART 1:

DUMP BODY WEIGHT DISTRIBUTION TABLE

SHOWING DIVISION OF BODY AND PAYLOAD WEIGHT
BETWEEN FRONT AND REAR TRUCK AXLES BASED ON UNIFORM LOAD DISTRIBUTION

1. Locate the body length in the "BODY" column at the left.
2. Follow this line over to the "CAB-AXLE" dimension.*
3. Drop down this column to the nearest wheelbase.
4. Follow this line to the left and read off the per cent of load on the FRONT AXLE.

*NOTE: This table presupposes a standard 3" space between cab and body—any space in excess of 3" must be subtracted from the CAB-AXLE dimension before it is applied to table.

BODY	C/A (CAB TO REAR AXLE) OR C/T (CAB TO TRUNNION)																												
7′					51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
7′6″		51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78
8′	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
8′6″	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84
9′	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
9′6″	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
10′	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
10′6″	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
11′	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
11′6″	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102
12′	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
12′6″	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108
13′	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
13′6″	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114
14′	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117
14′6″	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
15′	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	123	124

PER CENT OF LOAD ON FRONT AXLE — WHEELBASE—IN INCHES

1%	200																												
1½%	133	200																											
2%	100	150	200																										
2½%		120	160	200																									
3%		100	133	167	200																								
3½%			114	143	171	200																							
4%			100	125	150	175	200																						
4½%				111	133	156	178	200																					
5%				100	120	140	160	180	200																				
5½%					109	127	146	164	182	200																			
6%					100	117	133	150	167	183	200																		
6½%						108	123	139	154	169	185	200																	
7%						100	114	129	143	157	171	186	200																
7½%							107	120	133	147	160	173	187	200															
8%							100	113	125	138	150	163	175	188	200														
8½%								106	118	129	141	153	165	177	188	200													
9%								100	111	122	133	144	156	167	178	189	200												
9½%									105	116	126	137	147	158	168	179	189	200											
10%									100	110	120	130	140	150	160	170	180	190	200										
10½%										105	114	124	133	143	152	162	172	181	191	200									
11%										100	109	118	127	136	145	155	164	173	182	191	200								
11½%											104	113	122	130	139	148	156	165	174	183	191	200							
12%											100	108	117	125	133	142	150	158	167	175	183	192	200						
12½%												104	112	120	128	136	144	152	160	168	176	184	192	200					
13%												100	108	115	123	131	138	146	154	162	169	177	185	192	200				
13½%													104	111	119	126	133	141	148	156	163	170	178	185	193	200			
14%													100	107	114	121	129	136	143	150	157	164	171	179	186	193	200		
14½%														103	110	117	124	131	138	145	152	159	165	173	179	186	193	200	
15%														100	107	113	120	127	133	140	147	153	160	167	173	180	187	193	200
15½%															103	110	116	123	129	136	142	148	155	161	168	174	181	187	194
16%															100	106	113	119	125	131	138	144	150	156	163	169	175	181	188
16½%																103	109	115	121	127	133	139	145	152	158	164	170	176	182
17%																100	106	112	118	124	129	135	141	147	153	159	165	171	176
17½%																	103	109	114	120	126	131	137	143	149	154	160	166	171
18%																	100	106	111	117	122	128	133	139	144	150	155	161	167
18½%																		103	108	114	119	124	130	135	141	146	151	157	162
19%																		100	105	111	116	121	126	132	137	142	147	153	158
19½%																			103	108	113	118	123	128	133	138	144	149	154
20%																			100	105	110	115	120	125	130	135	140	145	150

CHART 2:

STANDARD DUMP BODY PROPORTIONS– HEIGHTS OF SIDES AND ENDS

APPROX. 1 CU. YARD ENDS

NOT LESS THAN 6" HIGHER THAN SIDES

CU. YD.	2		2½		3		3½		4		5		6	
LENGTH WIDTH	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS
7'-0" x 6'-0"	15	23	19	27	23	31								
7'-0" x 6'-6"	15	21	17	23	21	27								
7'-6" x 6'-0"	15	21	19	25	21	27								
7'-6" x 6'-6"	13	19	17	23	21	27								
8'-0" x 6'-0"	13	21	17	23	21	27	23	31	27	33	33	39		
8'-0" x 6'-6"	13	19	15	21	19	25	21	29	25	31	31	37		
8'-0" x 7'-0"	11	17	15	21	17	23	21	27	23	29	29	35		
8'-6" x 6'-0"	13	19	17	23	19	25	23	29	25	31	31	37		
8'-6" x 6'-6"	11	17	15	21	17	23	21	27	23	29	29	35		
8'-6" x 7'-0"	11	17	13	19	17	23	19	25	21	27	27	33		
9'-0" x 6'-0"	13	19	15	21	19	25	21	27	25	31	29	35		
9'-0" x 6'-6"	11	17	13	19	17	23	19	25	23	29	27	33		
9'-0" x 7'-0"	11	17	13	19	15	21	19	25	21	27	25	31	31	37
9'-6" x 6'-0"	11	17	15	21	17	23	19	25	23	29	29	35		
9'-6" x 6'-6"	11	17	13	19	15	21	19	25	21	27	27	33		
9'-6" x 7'-0"	9	15	13	19	15	21	17	23	19	25	25	31	29	35
10'-0" x 6'-0"	11	17	13	19	17	23	19	25	21	27	27	33		
10'-0" x 6'-6"	11	17	13	19	15	21	17	23	21	27	25	31		
10'-0" x 7'-0"			11	17	15	21	17	23	19	25	23	29	27	33
10'-6" x 6'-0"			13	19	15	21	17	23	19	25	23	29		
10'-6" x 6'-6"			11	17	13	19	15	21	17	23	21	27		
10'-6" x 7'-0"			11	17	13	19	15	21	17	23	23	29	27	33
11'-0" x 6'-0"			13	19	15	21	17	23	19	25	25	31		
11'-0" x 6'-6"			11	17	13	19	15	21	19	25	23	29		
11'-0" x 7'-0"			11	17	13	19	15	21	17	23	21	27	25	31
11'-6" x 6'-0"			11	17	15	21	17	23	19	25	23	29		
11'-6" x 6'-6"			11	17	13	19	15	21	17	23	21	27		
11'-6" x 7'-0"			11	17	13	19	15	21	17	23	21	27	25	31
12'-0" x 6'-0"					13	19	15	21	19	25				
12'-0" x 6'-6"					13	19	15	21	17	23	21	27		
12'-0" x 7'-0"					11	17	13	19	15	21	19	25	23	29
12'-6" x 7'-0"									15	21	19	25	23	29

APPROX. 2 CU. YARD ENDS

CU. YD.	4		5		6		7		8		10		11		12	
LENGTH WIDTH	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS	SIDE	ENDS
8'-0" x 6'-6"	25	37														
8'-0" x 7'-0"	23	35														
9'-0" x 6'-6"	23	33														
9'-0" x 7'-0"	21	31	25	37	31	43										
9'-6" x 7'-0"	19	29	25	35	29	41										
10'-0" x 6'-6"	21	31	25	35	29	39										
10'-0" x 7'-0"	19	27	23	33	27	37	33	41	37	47	47	55				
10'-6" x 7'-0"	17	27	23	31	27	35	31	39	35	45	45	53				
11'-0" x 6'-6"	19	27	23	31	27	37	31	41	37	45	45	55				
11'-0" x 7'-0"	17	25	21	29	25	33	29	39	33	43	43	49	47	55	51	59
11'-6" x 7'-0"	17	25	21	29	25	33	29	37	33	41	41	49	45	53	49	57
12'-0" x 6'-6"	17	25	21	29	25	33	29	37	33	41	41	49	45	53	49	57
12'-0" x 7'-0"	15	23	19	27	23	31	27	35	31	39	39	47	43	51	47	55
12'-6" x 7'-0"	15	23	19	27	23	29	27	35	29	37	37	45	41	49	45	53
13'-0" x 7'-0"	15	21	17	25	21	29	25	33	29	37	35	43	39	47	43	51
13'-6" x 7'-0"	13	21	17	25	21	29	25	33	27	35	35	43	37	45	41	49
14'-0" x 7'-0"	13	21	17	25	21	29	23	31	27	35	33	41	37	43	39	47

Note: All Side and End Dimensions shown are in inches.

TRACTOR EQUIPMENT

A very wide variety of items which may be installed on the truck chassis to be used for pulling a semi- or full-trailer fall into the general category of "Tractor Equipment."

The most common items include the following: • Fifth Wheels—standard type • Fifth Wheels—sliding type • Fifth Wheels—elevating type • Auxiliary Fuel Tanks • Brake Connections • Electrical Connections • Pickup Plates • Sanders • Pusher or Trailing Third Axles • V-Belt Drives for Third Axles • Cab-Guard Fenders • Safety-Tread Step Plates • "Pogo Sticks" or Antenna for brake and electrical connections • Hydraulic Lines for Dump Trailers • Hydraulic Lines for trailers equipped with lift gates • Winches, Gin Poles, etc., for cable dump trailers

Not only are many of the items necessary for a trailer pulling operation governed by Interstate Commerce Commission (ICC) regulations, but the type of trailer and its intended use will dictate the type of truck (conventional, LCF or Tilt-Cab), wheelbase, CA dimension and the components to be recommended. Also, the type of brakes (full air, air over hydraulic, vacuum or electric) on the trailer or trailers to be pulled will dictate the type of brakes with which the truck must be equipped. In some cases, a tractor is required to handle a variety of trailers with different types of brakes, and must be equipped with more than one braking system.

The growing popularity of hydraulic lifting or elevating Fifth Wheels for piggyback or fishyback operations, as well as for dumping purposes, require a transmission with sufficient power take-off openings and capacity to handle the hydraulic requirements.

Generally, trailer operations can be broken down into four categories: Over-the-highway—long distance; Over-the-highway—short haul; City pickup and delivery; and On-and-off-highway.

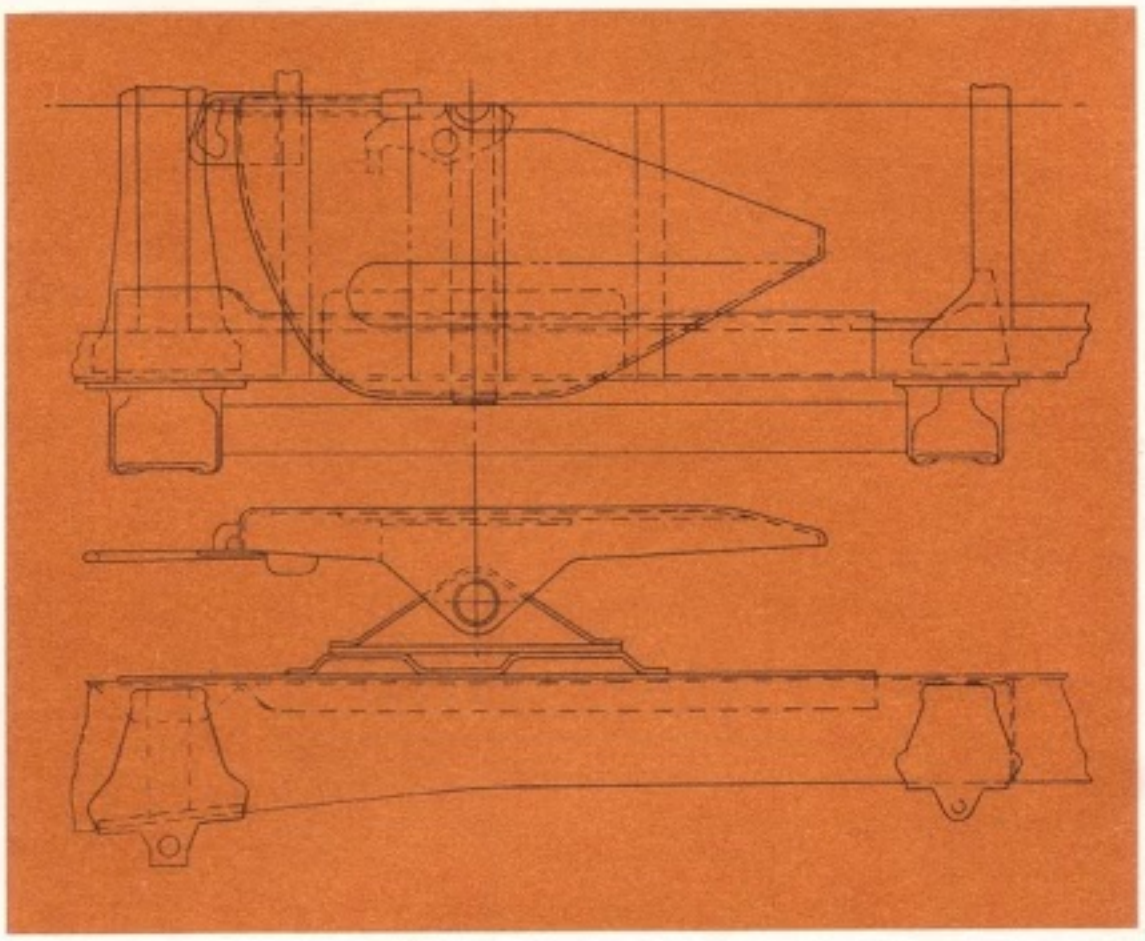
For ***over-the-highway—long distance,*** the basic requirements desired in the tractor are sufficient power and gear patterns to maintain maximum allowable speed, fuel economy, dependability, adequate brakes, adequate generator capacity for the lights involved and driver comfort.

Over-the-highway operators normally require a transmission-rear axle combination which provides close-ratio gear splits to maintain efficient engine power output for maximum speeds on grades and on the level. This may be achieved by any of several combinations: close-ratio transmission and 2-speed axle, multiple-speed transmission and single-speed rear axle, or main and auxiliary transmissions with single-speed rear axle. A tachometer is considered a must for over-highway operations.

The location of the fifth wheel king pin center on the tractor relative to the center line of the rear axle is the basis for calculating the load distribution which will determine the axle capacities, spring capacities, tire sizes and even the wheelbase of the tractor to be recommended in order to provide the necessary CA for clearance of the front of the trailer in right angle turns. *It is mandatory that this information, as well as the weight of the trailer and payload and the percentage of that weight which is carried on the king pin, be obtained from the operator or the trailer supplier.* Space required for saddle tanks, sanders, or other items to be installed back of the cab will also influence the CA and wheelbase to be recommended.

The high concentration of weight imposed on the chassis frame by fifth wheels dictates certain precautions in their installation:

1. *The fifth wheel mounting should spread the stress over the greatest possible frame area. After height and distance from rear axle have been determined, and fuel tank installation considered, a sub-frame should be fabricated from suitable channel iron, extending forward as close as possible to back of cab. If low fifth wheel height prevents use of a sub-frame, the fifth wheel mounting plate must be positioned to end at a crossmember.*
2. *The sub-frame, mounting plate, etc., supporting the fifth wheel, should be drilled to clear all rivet heads on the frame.*
3. *If fifth wheel supporting members contact the chassis frame only at intervals, this contact should be directly over the four rear spring hangers.*
4. *No holes should be drilled in the flanges of the frame side rails.*



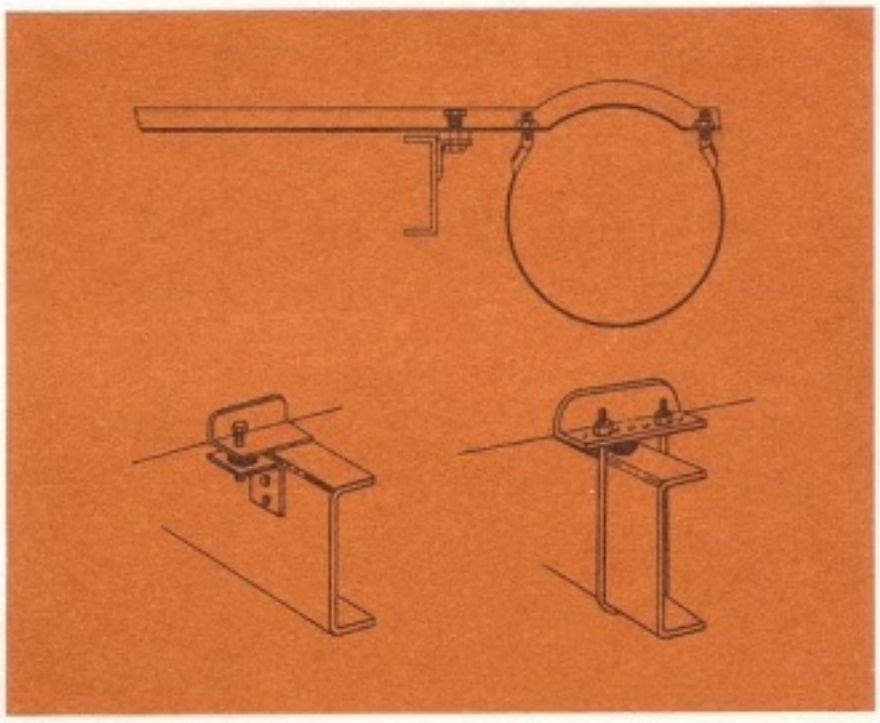
Since wind resistance, because of the large frontal area, is a very important factor in trailer operations, maximum engine power for the tractor in the GVW class required is always to be recommended.

Fortunately, most operators in long distance hauling are experienced or have qualified engineers to write the basic chassis specifications to meet their requirements, and the truck salesman is not often required to get into any highly technical problems. When necessary, do not hesitate to contact a qualified trailer distributor or factory branch for help.

Short haul operations — The basic requirements are practically the same as for long haul operations. However, the variation in types of terrain to be encountered may be less extreme. If no severe grades are involved, the engine power and range of transmission ratios may be less important. As the length of the run and the time the driver is in the cab diminishes, the cab comfort becomes a minor factor. Also, if no night driving is involved, a smaller capacity generator may suffice. The load carrying components should be recommended on the same basis as for long distance operations.

City pickups and delivery — For this type of service, speed becomes a lesser factor but shorter overall length, fast starting ability and maneuverability assume major importance. Tilt-cab or LCF models are favored for compactness, and lower rear axle ratios, or two-speed rear axles, enable fast getaways from stop lights in congested traffic and are less expensive than multi-range transmissions. Power steering is also to be recommended.

As a general rule, lighter trucks are used for city operations. However, hydraulic fifth wheels, to speed the hook-up and dropping of trailers, and dual braking systems are more likely to be encountered.



Typical saddle tank hanger installation — Selector valve, fuel pump and filter should be on right-hand side, so that only pipe crossing vehicle is from left-hand tank. Attachment methods should avoid drilling of frame-rail flanges.

On-and-off-highway — There are so many variations in the type of equipment and the uses for trailers in this category that no general recommendations can be made. Each tractor must be tailored for the exact equipment to be installed and its use.

Pulling power at low speed, power for hydraulically driven equipment, and rugged load carrying components are usually basic. It is not uncommon for a full trailer to be towed behind a semi in dump trailer, gravel hauling and strip mining work.

It is absolutely necessary to work with the equipment supplier in making recommendations for tractors to be used with these highly specialized types of trailers.

VAN PANEL BODIES

Chassis requirements and load distribution calculations for Van Panel body installations are basically the same as for regular platform and stake body models.

Occasionally, unusual load distribution situations do arise which require caution in recommending the wheelbase and load carrying components for a given length body. It should always be ascertained from the potential buyer if any of the unusual conditions listed below will exist.

1. Double deck loading in the forward portion of the body.
2. Carrying a load on the end gate of the body.
3. Body to be equipped with a hydraulic lift gate.
4. The commodity to be hauled shifts the center of gravity either backward or forward from the center line of the body.
5. Unusually heavy air conditioning or refrigeration equipment over the cab at the front end of the body.

Partial Double Deck Loading:

If this is to be done, the distribution of the payload weight should be calculated separately for each deck to determine the total weight to be carried on each axle.

Carrying a Load on the End Gate—

If this is done, the weight of the end gate and the payload on it, plus 25%, should be added to the weight to be carried on the rear axle and deducted from the weight to be carried on the front axle. In extreme cases, sufficient weight may be taken from the front axle to cause it to lift off the ground in going up grades or when bumpy roads are encountered. The solution is to recommend a longer wheelbase—sufficiently long to place 10% to 20% of the body and payload weight, including the weight of the end gate and load, on the front axle. The same solution applies to hydraulic lift gate equipped bodies.

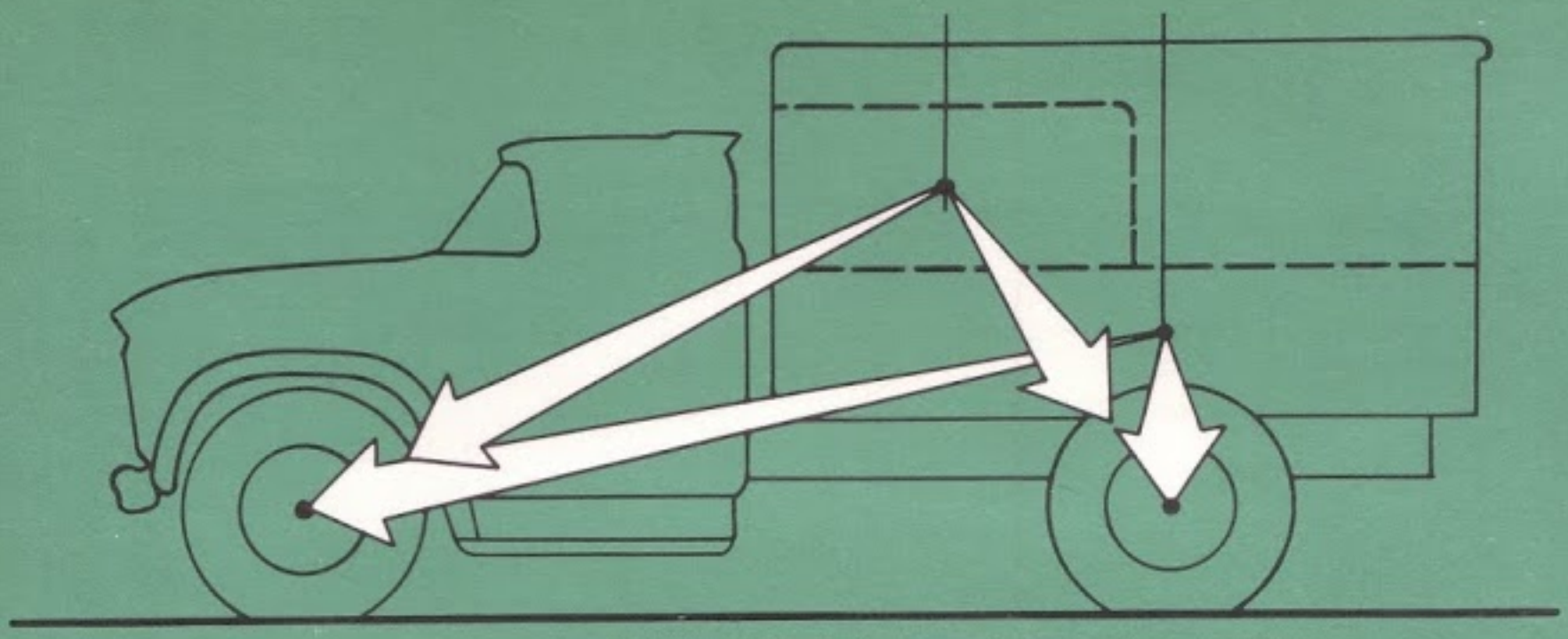
Commodities with Unusual Weight Distribution—

An example of such a commodity is upright pianos. The sounding board in the back of the piano is approximately 90% of its weight. If a full load of pianos is loaded facing forward, it in effect moves the center line of the load backward approximately 30″. This can, and has, caused the center line of the payload to be behind the rear axle, thus causing front end lightness. Hydraulic lift gates add to the problem.

Some types of farm equipment, furniture, machinery and appliances, can present even greater problems. The solution again is a longer wheelbase. The same situation can be encountered in improper loading of general merchandise but it is more often encountered where a truck is purchased for hauling a specific product.

Air Conditioning or Refrigeration Equipment Over Cab—

The weight of such equipment should not be included in the body and payload weight, but should be added separately to the load to be carried on the front axle.



Effect on weight distribution calculation of double-deck forward loading in van panel body.

TANK BODIES

Tank bodies are available in a wide variety of sizes and shapes and are used to haul a multitude of products, both liquids and pulverized solids. Generally however, they can be broken down into the following categories:

1. Compartmentalized Tanks.
2. Baffle-plated single-compartment tanks.
3. Single-compartment tanks without baffle plates.

A high percentage of tanks also require a pumping mechanism for either getting the commodity into the tank, to empty the tank, or both.

The capacity and types of pumps will vary from fairly simple low speed pumps which can be driven by a side mounted power take-off on the truck transmission to high-speed, high-output pumps required on airplane refueling trucks, bulk cement blowers, etc. The high capacity types require power dome take-offs, split shaft take-offs or separate engines, all of which must be capable of high speeds and often, full torque. *Therefore, it is of utmost importance that the tank supplier be contacted to determine the type of transmission or auxiliary transmission with which the truck should be equipped before making a recommendation and quotation to a potential buyer.*

Different types of tanks do present factors to be considered in calculating the body and payload distribution to select a truck having the proper wheelbase and CA dimension. (If a tank with wheelhousings is to be transferred from an old truck, its dimensions will determine the required CA of the new chassis—check them carefully.) Before proceeding with dimensional and weight distribution analysis, get the answers to the following questions:

Compartmentalized Tanks

1. Are all compartments to be filled with commodities having the same specific weight?
2. Are all compartments to be unloaded at the same time or are there numerous occasions when the front compartment may be emptied and the truck driven a considerable distance with only the rear compartment filled or vice versa?
3. Is there a storage compartment extending over one foot at the rear which will carry very little weight or excessive weight?

If any of the above conditions exist, the load distribution of each compartment with its load should be calculated separately to determine the maximum load which will be on either axle at one time. The

capacity of the axles, springs, and tires should be sufficient to carry this total maximum load.

Possibly, the storage or equipment compartment at the rear presents the most common problem. If the load ahead of this compartment averages 1,000 lbs. per foot and the rear compartment only 50 lbs. per foot, using the entire length of the body in calculating the load distribution will result in excessive weight on the front axle. This is quite common in asphalt spreading and similar types of tank trucks.

The solution is to use only the body length which carries the commodity in calculating the original load distribution. The weight of the rear storage compartment with its normal load should then be added to the rear axle load and deducted from the front axle load, providing of course that this compartment is behind the rear axle.

In rare instances, the rear compartment may be loaded more heavily than those ahead. The result is excessive weight on the rear axle and lightness on the front. Again, the solution is to calculate the load weight of the rear compartment separately, add it to the rear axle and deduct it from the front, and recommend the proper longer wheelbase.

Baffle-Plated Single Compartment Tanks

Unless there are some very unusual conditions, this type of tank presents no special load distribution problems and can be calculated in accordance with the standard load distribution formula.

Single Compartment Tanks Without Baffle Plates (liquids)

Because of the surge encountered in stopping and starting with a partial load, there will be occasions when one-half the payload may be entirely on either axle. Therefore, it is recommended that first the weight distribution of the body alone be calculated. Then one-half the payload weight be calculated and added to the chassis and body weight on the front axle. The capacity of the front axle, springs, and tires should equal approximately 75% of this total. (Chassis, body and one-half of payload weight.)

The capacity required for the rear axle, springs, and tires may be calculated in accordance with the standard load distribution formula. Unless extremely steep grades are to be encountered with a partial load, this will suffice because the regular load distribution contemplates a high percentage of the load will be on the rear axle.

REFUSE COLLECTION BODIES

Bodies for the collection of garbage and rubbish are basically supplied in two types:

Rear End Loaders—unloaded by dumping

Side Loaders—load pushed out at rear end

In addition, semi-trailer types are available, for which tractor chassis requirements are similar to those of tractors for dump trailers.

Bodies for this purpose, in both types, are available in the approximate sizes listed below and require chassis with the GVW ratings and approximate CA dimensions indicated.

BODY CAPACITY	MINIMUM CHASSIS GVW RECOMMENDED	MINIMUM CA RECOMMENDED REAR END LOADER	MINIMUM CA RECOMMENDED SIDE LOADER
12 cu. yd.	18,000	84	102
14 cu. yd.	19,500	84	102
16 cu. yd.	19,500	102	102
20 cu. yd.	21,000	120	120
24 cu. yd.	23,000	140*	140*

*To obtain these CA lengths, it is usually necessary for body supplier or some other source to extend wheelbase. In most cases, tandem models are to be recommended for bodies above 20 cubic yards.

Whether the material is to be wet garbage, mixed garbage and refuse, or strictly dry rubbish will determine the exact GVW required. This information should always be obtained and discussed with the body supplier before making a recommendation and quoting a price.

Chassis for Rear End Loading Types

Since the loading and packing mechanism for these types is at the extreme rear end of the body and when dumped, over 100% of the load and body is on the rear axle, the capacities of the rear axle, springs and tires should be the maximum available for the truck model with the GVW rating required. Because of this weight concentration at the extreme rear, it is often necessary for counter-weights to be installed on the front axle by the body supplier to prevent the front end from lifting off the ground when dumping.

Frames should be of maximum strength with reinforcements where available because of the dumping action.

Five-speed or automatic transmissions with high PTO output are recommended because of the take-off power required for operating the packing and dumping mechanism.

Two-speed axles are preferred by some users but should be optional, depending upon terrain at the dump and user preference.

Side Loading Types

No unusual load distribution is encountered with this type since it does not dump and the packing mechanism operates from the front. However, there is a momentary situation during unloading when a high percentage of the load is at the rear, so heavy-duty rear axles, springs and tires are to be recommended.

Standard frames for the required GVW capacity will suffice because there is no dumping action.

Power requirements from the transmission take-off are comparable to those for the end loading type, so five-speed or automatic transmissions with high-output PTO's are recommended.

General—*both types*

Due to the extreme stop-and-go, cramped-quarters operation and high idling time involved, the following items should be considered in all proposals on trucks for refuse collection service:

1. Power Steering
2. Automatic Transmission
3. Diesel Engine
4. Positive Crankcase Ventilation
5. Heavy-Duty Radiator
6. High Output Generator
7. Front-Of-Engine PTO for 20 cu. yd. and larger bodies
8. Power Dome Take-Off for tandem models
9. On and Off Highway Rear Tires
10. Tilt-Cab Models for ease of entry and exit
11. Heavy-Duty Clutch if automatic transmission is not used

In some areas, the refuse collection trucks are also equipped with snow plow attachments for emergency use. Determine if this is a requirement. If so, do not promote Tilt-Cab models and make sure take-off openings are available to operate two hydraulic systems.

WINCHES AND CRANES

Winches

As with snow plows, winch operations are usually a secondary truck application, the winch equipment being installed in conjunction with a body or some other special equipment. Therefore, it is necessary to have full information on the other type of equipment as well as the winch to be installed. If the other equipment also requires power, two take-off openings on the transmission, a split shaft take-off, power dome on the auxiliary transmission, or some other source of power will be required.

In general, winch installations fall into either the front-mounted or back-of-cab-mounted categories: *Front Mounted Winches* are more commonly used on lighter trucks and are often installed for the sole purpose of pulling the truck out of or through terrain that the truck cannot negotiate under its own wheeled power. In such cases, the capacity of the winch line pull need only equal approximately 80% of the total GVW of the truck, and a simple side mounted transmission power take-off will supply adequate power.

Since the winch is installed at the front of the frame, all of its weight is carried on the front axle. In calculating load distribution, this weight should be added to the front axle load, and front spring, axle, and tire capacity recommended accordingly.

In connection with cranes, hydraulic or mechanical leveling jacks are usually employed to take the load and side sway when the crane is in operation. In these cases, the capacity of the truck need only be sufficient to carry the weight of the crane and other body and payload weight when the truck is being moved from one location to another. This situation also applies to truck mounted drilling rigs, etc. However, additional sources of power may be necessary to operate the jacks.

Units have been sold for tree moving service where a front mounted winch, hydraulic hoist under a

platform body, a two-ton capacity crane, and hydraulic leveling jacks were all installed on a truck and the truck engine supplied all of the power. In such cases, both power take-off openings on a five-speed transmission and a split shaft take-off were required.

The suppliers of cranes and similar equipment can easily and quickly give you the specifications of the truck chassis required for the unit and use involved. Therefore, what may appear to be a highly complicated deal can develop into an easy and profitable sale.

In a high percentage of cases, other power driven equipment will be installed on the rear of the truck. This may be a dump body, crane, post hole digger, or even another winch. In any case, two or more sources of power will be required. This will dictate the type of transmission and/or auxiliary with which the truck must be equipped.

Back of Cab Mounted Winches are usually higher capacity or high-speed types with reversible features which require more complicated power take-offs. Often, sufficient power or speed cannot be obtained from the truck transmission, making split shaft, power dome or flywheel drives mandatory. In these cases, truck transmission selection is not affected by power take-off requirements.

These installations are usually made directly behind the cab and because of their concentrated weight, heavy-duty frames with frame reinforcements are recommended (or equipment supplier should add reinforcement). However, certain underslung and capstan type winches used by some utility companies may be installed anywhere along the frame or even on the side of the frame. Therefore, close cooperation with the winch and other equipment suppliers is necessary before making recommendations and quotations on the chassis components.

Cranes

These installations may involve mechanical drives operated by winches and cables or hydraulic drives. In either case, one or more power take-off openings on the transmission will be required unless a low capacity electrically operated unit is involved.

SNOW PLOWS

Snow plowing is, in most cases, a secondary use of the truck being purchased, and snow plows may be added to all sizes of trucks with practically all types of bodies. Therefore, in selling almost any type of truck to a municipality or public utility in the snow belt areas, it should always be ascertained if they plan to use a snow plow with it. Most highway maintenance dump trucks, and the refuse collection trucks in many cities, are to be equipped with snow plow attachments.

The lifting mechanism of the snow plow attachment is usually hydraulically driven from the following power sources:

1. Hand hydraulic pump in or behind cab.
2. Electrically driven from fan belt.
3. From transmission power take-off.
4. From front-of-engine crankshaft power take-off.
5. From auxiliary transmission power dome.
6. From split shaft power take-off.
7. From flywheel power take-off.

The size and type of truck, as well as the size and type of snow plow to be used, will usually dictate the type of drive required. To best serve as a guide for our recommendations, the truck capacity groups, as listed below, will be used.

Light-Duty Trucks for up to 8′ One Way —Angle Blade Plows

1. *Drive*—usually fan belt or transmission side mounted take-off.
2. *Attachment*—usually attached to front bumper or front end of frame.
3. *Chassis Recommendations*—
   a. Heavy-Duty Front Springs.
   b. Four-Speed Transmission with PTO opening.
   c. Extra Capacity Generator.
   d. Heavy-Duty Battery.
   e. Windshield Washer.
   f. On and Off Highway Rear Tires.

Medium-Duty Trucks for 8′ to 12′—One Way Blades

1. *Drive*—transmission mounted PTO.
2. *Attachment*—front bumper, front of frame or underframe.
3. *Chassis Recommendations*—
   a. Heavy-Duty Front Axle and Springs—Weight of plow is usually 6′ to 8′ ahead of front axle.
   b. Five-Speed Transmission with two PTO openings—dump body, garbage body or other power requirements need other PTO opening.
   c. Two-Speed Rear Axle—for extreme low speeds and power in plowing.
   d. Extra capacity generator with charge at low speed.
   e. Heavy-Duty Battery.

f. Windshield Washer.
g. On and Off Highway Rear Tires.

Heavy-Duty Trucks for One Way, Reversible, V-Type, and Side Wing Plows

1. *Drive*—transmission, front-of-engine, auxiliary transmission power dome, split shaft or flywheel take-off. (Depends on other equipment to be installed on truck and recommendation of snow plow manufacturer.)
2. *Attachment*—front of frame or underframe.
3. *Chassis Recommendations*—
   a. Heavy-Duty Front Axle and Springs.
   b. Transmission—to be based on other equipment on truck, plus recommendation of snow plow manufacturer.
   c. Two-Speed Rear Axle.
   d. Extra capacity generator with charge at low speed.
   e. Heavy-Duty Battery.
   f. Windshield Washer.
   g. On and Off Highway Rear Tires.

General—

When side wings (leveling wings) are to be installed, a space of from 16″ to 24″ is required behind the cab for the hydraulic control unit. This space should be taken into consideration in recommending the proper wheelbase for the length of body to be installed.

A check should be made to assure that the overall width of the truck with dual wheels is not greater than the plowing width or path of the plow. The same applies to the front wheels when in full turning position to assure they do not project beyond the plowing width.

The weight of the plow and attachment should be obtained from the user or manufacturer and added to the front axle load in calculating load distribution and recommending front axle components. A load is usually carried in the body during plowing operations to give added traction on the rear wheels. If this is not to be done, the customer should be cautioned that sufficient traction may not be available and a shorter wheelbase truck than that normally recommended for the length of body involved may be necessary.

Currently, we do not know of any satisfactory arrangement for installing snow plow attachments on Tilt-Cab type trucks because the plow attachments interfere with the tilting operation. Therefore, Tilt-Cabs should never be recommended for snow plow use unless you have full assurance of a satisfactory operation from the snow plow manufacturer.

If auxiliary fuel tanks, air tanks, winches, side mounted batteries, or other similar equipment is to be installed on the truck, a check should be made with the snow plow supplier to assure that there will be no installation conflicts.

A GLOSSARY OF TRUCKING TERMS

Courtesy of FLEET OWNER Magazine

Air Resistance—A measure of the "drag" on a vehicle moving through air. Air resistance increases as a square of the speed, thus power requirements increase much faster than vehicle speed.

Ambient Temperature—Outside air temperature.

Auxiliary Transmission—A transmission with a limited number of speeds (usually two, three or four) that is mounted immediately in back of the main transmission. The auxiliary has its own control in the cab, and by using both transmissions the driver can get several times the number of forward speeds possible than with just the main transmission. A five speed main transmission with a three speed auxiliary would give the driver fifteen forward speeds.

Axle—Dead—A dead axle is merely a means of support for the wheels at each end. This is contrasted to a 'live' axle which is connected to the wheels and rotates with the wheels.

Axle—Drive—The drive axle is the axle that is geared to the truck engine and propels the truck.

Axle—Full Floating—The type of drive axle most often used on trucks. With this arrangement the axle 'floats' in the axle housing with all the truck weight and stress of the wheels on the housing, not the axle shaft.

Axle—Semi-Floating—With this arrangement the weight of the truck, with consequent load and wheel stress, is supported by the axle shaft.

Axle—Tandem—Two axles—parallel mounted, usually found at the rear of a tractor or truck, and very often at the rear of a trailer. The truck or combination can legally carry more payload with this axle arrangement.

Axle—Tandem Drive—Both axles of the tandem are driven by the vehicle engine with this set-up.

B.A.—The distance from the foremost point on the front bumper to the centerline of the front axle.

B.B.C.—The distance from the foremost point on the front bumper to the back of the cab.

Bogie—A tandem axle.

Bridge Formula—Certain states compute the maximum allowable weight for vehicles by a 'bridge formula.' Total weight, number of axles, location of axles and total wheelbase are factors in this formula as well as maximum overall length.

C.A.—This is the distance from the back of the truck cab to the center of the rear axle. When truck has tandem axles this dimension is from back of cab to a point midway between two rear axles.

C.B.—Distance between truck cab and body.

Cab Forward—A truck cab design that places the driver well forward with practically no hood. Used in light delivery trucks extensively.

C.O.E.—Cab over engine. Cab design where driver is actually as far forward as possible. Engine directly under cab.

Common Carrier—A trucking firm that hauls for hire. I.C.C. regulates the highways they may use and cities they may service when delivering and picking up freight. This type of trucker competes directly with the railroads.

Contract Carrier—This trucking firm has a hauling contract with a certain company or companies and is not licensed to haul for hire such as the common carrier. Some trucking companies are licensed to do both types of hauling—however, separate rights must be obtained for each.

Cube—The inside dimensions of a truck body or trailer—expressed in cubic feet. So-called high-cube equipment is designed to offer the maximum interior load space for its exterior length and width.

Curb Weight—The weight of an empty truck including fuel, coolant and oil.

Deflection Rate—Used in rating springs. The number of pounds necessary to deflect a spring one inch. For torsion bars it is one inch deflection of the control arm.

Differential—The gear assembly on the drive axle which permits one wheel to turn more slowly, or faster than the other one when going around corners.

Differential—No Slip or Limited Slip—This type of differential will not allow one wheel to spin while the other is motionless—such as when a truck is stuck on ice or in mud. Torque is transmitted to both drive wheels for better traction. This type of differential is available on almost all cars and trucks today as an option, and standard equipment on some.

Double Bottom or Tandem Trailers—A combination consisting of a tractor pulling a semi-trailer with a full trailer in back.

Driveline—The truck drive shaft and universal joints.

Dromedary—A straight truck with chassis arranged to haul a trailer.

Fifth Wheel—This is the round plate found on the back of a tractor. It acts as the coupling device for the semi-trailer.

G.C.W.—Gross Combination Weight—This is the total weight of a tractor and trailer or trailers, including payload.

Glad Hand—The air brake connector between a tractor and trailer.

Gradeability—A truck's ability to negotiate a given grade at a specified G.V.W. or G.C.W.

G.V.W.—Gross Vehicle Weight—This is the total weight of the truck with payload.

Gypsy—A slang expression for the single truck or tractor owner who will haul for anyone anywhere.

Hold Over Plates—Plate coils containing a refrigerant that are mounted on the walls of a truck or trailer. When "charged" these plate coils hold the temperature down to the desired point for milk delivery and many other low temperature trucking operations.

Horsepower, Gross—The brake horsepower of an engine with optimum ignition setting (manual instead of automatic advance) and without allowing for the power absorbed by the engine's accessory units such as the fan, water pump, generator and exhaust system. Gross torque is used to determine gross horsepower.

Horsepower, Net—The brake horsepower remaining at the flywheel of the engine to do useful work after the power required by the engine accessories (fan, water pump, generator, etc.) has been provided.

Hotchkiss Drive—Hotchkiss drive is a term applied to that type of chassis design where the rear springs are mounted at the forward end in a stationary bracket (not shackled as at the rear end); and, all driving and braking forces are cushioned by the springs and transferred directly to the frame side members. Open-type universal joints and propeller shafts are used in this design.

Inter-Axle Differential—This is sometimes called a torque divider differential. This device is located between two driving axles of a tandem axle drive truck or tractor. The power from the engine is divided between the two driving axles when this device is in the unlocked position. One axle can actually turn faster, or at a different speed than the other, which is an advantage in certain types of truck use. This device can be locked, under which conditions both axles turn at exactly the same speed, getting approximately 50% of the power to each.

Kingpin—For Front Axle—Pin which connects front axle and steering knuckles, about which the knuckles pivot.

Kingpin—For Semi-Trailer—Pin which is locked into fifth wheel on tractor to effect coupling of trailer with tractor.

Landing Gear—The two small wheels at the forward end of a semi-trailer. Used to support trailer when detached from tractor.

Lessee—A company that has obtained vehicles by leasing them.

Lessor—The leasing company.

Lease—Finance—A finance lease arrangement merely provides the vehicles. The fleet company must provide maintenance, insurance and pay for depreciation.

Maintenance Lease—This is sometimes called fixed cost leasing. The leasing company provides insurance, all maintenance and covers depreciation.

Nominal Rating—This is the manufacturer's rated capacity of the truck. This is a term for payload only and is expressed in tons, such as ton and a half, two ton, five ton, etc.

Odometer—A mileage counter. Registers total miles travelled. Located on the dial section of most speedometers.

Parallel—Parallel hook-up of truck batteries means that all batteries (some trucks carry four batteries) have their plus terminals connected on a separate wire and all minus terminals on another separate wire. This means that four six volt batteries will still only produce six volts but have four times the energy potential.

Payload—This is the manufacturer's rated capacity of the truck expressed in pounds. Means the same as nominal rating which is expressed in tons or fractions of a ton.

Payload & Body Allowance—This is the payload capacity of the truck with allowance for the weight of a truck body.

Peddle Truck or Shuttle Truck—These are terms for the city delivery trucks owned by a long distance hauler. They distinguish between the big 'rigs' and the small city trucks.

Percent of Grade—This figure used in computing the power requirements of a truck. Usually taken at the steepest grade a truck will be required to climb on its route. Percent of grade is determined by dividing the height of a hill by its length.

Pintle Hook—Hook mounted on truck or semi-trailer used to couple on a full trailer.

Power Take-Off (P.T.O.)—This is a place on the truck transmission, or driveline where auxiliary devices can be connected in order to use the truck's engine power. This arrangement is sometimes used to drive cement mixers as well as mechanical refrigeration units for frozen food hauling.

Power Train—All the components that handle the engine power from the truck engine to the driving wheels. This includes transmissions, driveshafts, as well as differentials and driving axles.

Private Fleet—A truck fleet owned for a company's own use. The truck fleet owned by a food company to deliver its own products is an example.

Pusher Type Tandem—A tandem axle which has the driveshaft connected to the back axle of the tandem. This arrangement is sometimes used to accommodate a 'V' belt drive running from the back or drive axle of the tandem to the forward axle of the tandem.

Radius Rod—Radius rods are found in several automotive applications. Most common use is for keeping rear axle in correct position when starting and stopping.

Rear Axle Ratio—This is the numerical ratio of the driveshaft speed to the speed of the rear axle.

Rim Pull—See Tractive Effort.

Resisting Bending Moment (R.B.M.)—Section modulus x yield strength. This is used when comparing the strength of two frames made of different materials.

Road Rolling Resistance—Different road surfaces offer various resistances to the wheels of a truck. A concrete surface offers 12.5 lbs. of rolling resistance per thousand pounds of gross weight. Gravel is 25 lbs. and sand is 75 lbs. This is a vital factor in determining power and power train requirements.

Rolling Radius—Height measured from center of rear axle to the ground.

Section Modulus—A measure of the strength of frame side rails determined by the cross-section area and shape of the side rails.

Semi-Trailer—A trailer that has its wheels at the back only. Can be single axle or tandem. Front of trailer rests on back of tractor when in use.

Single & Double Reduction Gears—This is generally rear axle terminology. Standard rear axle gearing is single reduction—i.e., one step of speed reduction through the rear axle gearing. In certain heavy duty applications a double reduction is desirable. This allows a greater gear reduction in a smaller gear case, thus allowing better road clearance and more compact design.

Swing Axle—This is a drive axle arrangement found on some passenger cars and some light duty trucks. The differential is mounted rigidly on the vehicle frame and the axle shafts are allowed to 'swing' as the vehicle moves up and down while running. Lower unsprung weight is one advantage of this system. Universal joints are required on each half of the drive axle to accommodate the vertical motion.

Synchronized or Synchromesh Transmission—This is a truck transmission which has built-in devices to automatically match the rotating speeds of transmission gears. With this type of transmission "double clutching" is not necessary.

Taxable Horsepower—This is truck horsepower figured by a mathematical formula for taxation purposes.

Tachometer—An instrument that indicates the revolutions per minute of the truck engine.

Torque—The rotating or twisting force developed by the truck engine. This is one of the two factors in figuring horsepower and is always expressed in pounds feet. At a given r.p.m. the higher the torque, the greater the horsepower. The higher the torque rating of a truck engine, the greater its ability to climb hills and increase speeds. The high torque truck engine eliminates a lot of gear shifting for the driver.

Torque Convertor—Used in truck and car automatic transmissions. Torque is multiplied by the action of various turbine-like elements on a fluid.

Torque Multiplication—The truck transmission as well as rear axle gears multiply the engine's torque. This is done by reducing engine speed through gears, thus increasing torque by reducing revolutions per minute.

Tractive Effort—The force exerted by the tires on the drive wheels on the road. This is the force which propels the vehicle and is known as Tractive Effort or Rim Pull.

Tractive Factor or Performance Factor—This is tractive effort per thousand pounds of gross vehicle weight. A means of measuring the performance potential of a truck or tractor.

Tread—The distance between the centers of tires on the same axle at the points where they contact the road surface. Duals are measured from the center of dual wheels.

Turning Radius—The shortest distance in feet required for a given truck to negotiate a U-turn or make a 180 degree turn. The smaller the turning radius of the truck, the greater its maneuverability and consequent ability to handle well in traffic or congested areas.

Twin Screw—Slang term for tandem drive.

Two-Speed Axle—A rear axle arrangement whereby the driver can select one of two axle ratios. A truck with a two-speed axle and a five-speed transmission would have ten forward speeds.

Universal Joint—Truck drive shafts have universal joints to allow for vertical motion of drive axle and change of angle due to truck loading. Universal joints are used wherever a drive or control shaft must have a change of angle along its axis.

Unsprung Weight—All the vehicle weight that is not supported by the truck's springs. This would include wheels, tires, brakes, axles and driveshaft. The objective of design engineers is to reduce unsprung weight to a practical minimum.

Walking Beam Suspension—This term used to describe a type of tandem suspension that has equalizing beams connecting the two axles. In parallelogram design such as this, wheels "walk" over irregularities in the road surface.

Weight Distribution—This is the percentage of the vehicle's total weight that rests on each axle. Completely even weight distribution is usually impossible, however, the closer to equal, the better. Most states have axle weight limit laws, as well as overall weight laws. The truck in question may be well under the maximum allowable weight, however, be overweight on a single axle. This is still a violation of the law.

Weight, Sprung—The weight of those things supported by the springs, such as frame, engine, body, payload, etc.

Wheelbase—The distance between the centerlines of the front and rear axles. For trucks with tandem rear axles, the centerline is midway between the two rear axles.