

**BELL SYSTEM PRACTICES**  
**Outside Plant Construction**  
**and Maintenance**

**SECTION G92.400.1**  
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**WINCHES AND POWER TAKE-OFFS**  
**GENERAL**

<b>Contents</b>	<b>Page</b>
1. General .....	1
2. Precautions .....	1
3. Types of Winches and Their Drum Capacities....	3
4. Winch Clutch and Brake .....	5
5. Winch Worm Brake .....	6
6. Power Take-Offs .....	7
7. Winch Operation .....	8
8. Maintenance .....	12

**1. GENERAL**

1.01 **Single-drum winches** are available for mounting on construction trucks which do not require a live boom line to operate the derrick. **Double-drum winches** are available for the construction trucks which do require a live boom line for operating the derrick. The **Earth Boring Machine Winch** is available for mounting on trucks which are equipped with a large boring machine of the HC or HD type which have an integral derrick. This section includes information which is common to all three of the above types of winches as well as information concerning the power-take-offs which are used to drive these winches. Additional information concerning any one of the above types of winches is contained in individual sections of this series of practices.

1.02 This section replaces Section J6.751, Power Winches—General.

**2. PRECAUTIONS**

2.01 Truck mounted winches are powerful tools, and extreme care must be exercised in their use. All personnel should be familiar with the signals described in the section of the G10 division of practices, entitled, "Signals for Use of Outside Plant Forces." The signals should be periodically reviewed to insure familiarity at all times. Responsibility for

giving proper signals should rest with the gang foreman or a designated workman. Other workmen can, of course, give signals or directions in case of emergency.

2.02 The truck operator should be thoroughly familiar with the operation of the truck, the power take-off and the winch, and should know the effect on the winch and its load of the truck clutch, accelerator pedal, truck transmission and power take-off lever movements.

2.03 An instruction card, in the form of a gummed sticker, showing the operating positions of the power-take-off lever, and the winch clutch and brake lever is available. The sticker should be so placed in the cab as to be readily seen by the truck operator. Suggested locations are: on the instrument panel in front of the operator's seat, or on the windshield header, directly under the caboscope. The operator should check his operating procedure against the lever positions shown on the sticker. A workman, not the regular operator, who is required to move the truck in the operator's absence, should check the lever movements with the diagram before attempting to drive the truck or winch.

2.04 The foreman should see that no one is close to the winch line, or under a pole derrick, or under a load suspended from the derrick, or in danger of being struck by the load when the winch or the truck is moved. He should, in so far as possible, make sure no one is in a position to be struck by a winch line which might break under load. He should also check the position of truck, derrick or load to guard against striking any obstruction which might be present. The winch operator should, in so far as possible, observe these same precautions.

2.05 Care should be taken by all personnel to stay out of angles formed by the winch line. Moving winch lines, whether or not under load, should be handled only with gloved hands, and then with **extreme caution**. At least 3 feet of distance should be maintained between a workman's hand on the line, and any sheave, block, or eye, or from the winch drum itself.

2.06 The engagement of the combination winch clutch and brake should be checked to make sure it is properly engaged before attempting to move a load with the winch line. If the clutch does not engage the winch drum immediately when the lever is moved to the "Clutch In" position, another workman should be requested to pull back on the winch line while the truck operator continues attempting to move the lever into position. The clutch should then engage with a characteristic click. If difficulty is still experienced with the clutch it should be reported to the motor vehicle maintenance forces.

2.07 The truck operator should inspect his winch daily to detect excessive oil leakage around bearing retainers, or difficulty in moving the winch clutch, and should be on the alert to detect unusual noises and excessive heat during operation of the winch. Further instructions covering these matters are given in the paragraphs covering the maintenance of the winches.

2.08 The condition of the winch line should be frequently checked to detect broken strands. It should be inspected and cared for in accordance with the section on Wire Rope—General. Care should be taken to keep the line free of kinks and snarls. If the line becomes tangled on the drum during a hard pull, it should be straightened by paying out, and then carefully rewound before attempting another pull.

2.09 When rewinding a line, or putting a new line on a winch not equipped with a winch rope winder, the workman should use a lag, or a manhole cover hook to guide the line. He should make sure his footing is secure, and there is no danger of his feet or the guide slipping. He should wear gloves, and if necessary to handle the line, keep his hands at least 3 feet away from the winch drum. The operator should drive the winch very slowly during the winding operation and tension should be maintained on the winch line during the entire operation.

2.10 In general, it is recommended that workmen stay out of the truck body when guiding winch lines onto the winch drum.

### **3. TYPES OF WINCHES AND THEIR DRUM CAPACITIES**

3.01 The various types of winches in general use together with winch drum capacities are covered in the following paragraphs.

3.02 Single-Drum Winches. The single-drum winches currently in use are:

L12 Winch

L18 Winch

D Single-Drum Winch (Divided Drum)

UG Single-Drum Winch

FM L12 Winch

3.03 Double-Drum Winches. The double-drum winches currently being used are:

Double-Drum Winch (Old Type)

Double-Drum Winch

3.04 Earth Boring Machine Winch. The Earth Boring Machine Winches currently being used are:

HC-EB Winch

HD-EB Winch

3.05 Winch drum capacities, of the various winches, in feet of wire rope are shown on the following tables.

Type of Winch		Winch Drum Capacities in Feet of Wire Rope						
		Hand Wound				CH Winch Rope Winder		
		Size of Wire Rope						
		Large Drum			Small Drum	Large Drum		
		5/16"	3/8"	7/16"	1/2"	5/16"	3/8"	7/16"
L12		1350	1000	750	—	2000	1500	1100
L18		2000	1475	1125	—	3000	2350	1700
D Single Drum Winch	Long Section	1800	1300	1000	—	2700	1950	1500
	Short Section	650	500	375	—	—	—	—
UG Single Drum Winch		2160	1800	1400	—	3250	2700	2100
FM-L12 Winch		525	360	280	—	—	—	—
Double Drum Winch (Old Type)		1350	1000	750	200	2000	1500	1100
Double Drum Winch		1800	1300	1000	300	2700	1950	1500
HD-EB Winch		1350	1000	750	—	2000	1500	1100
HC-EB Winch		1800	1300	1000	—	2700	1950	1500
*-EB Winch Small Drum		650	500	375	300	—	—	—

\* Same for HC & HD

#### 4. WINCH CLUTCH AND BRAKE

4.01 The winch clutch and brake is mounted on the winch shaft between the worm drive housing and the drum it controls. It is a dual-purpose device; the clutch permits the drum to be keyed to, and driven by the winch shaft, or to run freely on the shaft as desired; the brake serves to slow down or stop the free drum rotation and is not designed to hold a load.

4.02 The winch clutch consists of a flanged collar, mounted on the drum shaft, with teeth cut in the edge that match similar teeth cut in a projection on one drum flange. The clutch flange is faced with brake lining material. An outer sleeve is mounted on the flanged collar and is free to slide about 1/4 inch on the collar. Inside the clutch is a system of steel balls, lying in grooves, which serve to lock and unlock the clutch by depressing two spring loaded pins installed in a hole in the shaft. The clutch is locked by these pins when the clutch is in the engaged position. The control lever in the truck cab is connected to the clutch by means of control cable, or by steel connecting rods.

4.03 Moving the control lever towards "Free Drum" position moves the sleeve on the flanged collar, which causes the locking pins to be pushed out of the way. Continuation of the lever motion moves the entire clutch assembly toward the drum, disengaging the clutch teeth. The drum can then freely rotate and the lever may be released. The clutch will remain disengaged until the lever is again moved. To return the clutch to the engaged position, pressure should be maintained on the lever until the clutch engages. Full engagement is accompanied by a characteristic clanging sound. If the clutch does not engage immediately another workman should be requested to pull back on the winch line until the characteristic clanging sound is heard. If the sound is not heard almost immediately the winch should be reported to the motor vehicle maintenance forces.

4.04 Application of the brake is accomplished by moving the mechanism toward the winch drum to the limit of its travel, which brings the brake lining against the machined face on the drum flange. Pressure must be kept on the lever to keep the brake on. Release of the pressure permits a heavy coil spring to push the brake away from the drum into free drum position. The brake is not intended to hold the drum against a load, but is intended merely to slow down and stop the drum to prevent the winch line from spilling over and becoming tangled.

## 5. WINCH WORM BRAKE

5.01 All of the winches are equipped with an automatic winch worm brake. The worm drive on these winches is of the so-called irreversible type, that is, the winch will not normally overrun and permit a load suspended from a derrick to creep downward when power is cut off from the winch. As the worm drive wears it tends to lose this irreversible feature and a suspended load may overspin the gears and creep downward. The worm brake was designed to correct this tendency.

5.02 The brake consists of a brake disc, mounted on the end of the worm shaft, which bears lightly against a brake lining on a plate attached to the worm drive housing.

5.03 The action of the brake is as follows: Whenever there is a load on the winch line, the resistance of the load causes the winch worm to move forward to the limit of its end play. This action maintains a light contact between the brake disc face and the brake lining. When the winch is stopped, the pull of the load on the line tends to turn the drum backwards, which in turn tries to drive the worm in reverse. When the worm turns in the reverse direction the light contact between the brake disc face and the brake lining keeps the worm brake nut from turning until the worm makes one revolution. When this happens the worm brake nut screws forward on the worm brake stud pulling the brake disc with it. This forces the brake lining against the brake plates and the brake disc and results in full braking effort.

5.04 When there is no load or a very light load on the winch line the springs in the winch worm brake act to provide 1/32-inch clearance between the brake disc and the brake lining. Therefore when the worm turns in the reverse direction the worm brake nut turns with it and braking action does not occur.

5.05 When the winch line is being payed out under load the winch worm brake is delivering full braking effort but is being overpowered by the truck engine. If the engine is run at high speed during this operation the brake will tend to overheat and when the clutch pedal is depressed the gears will tend to overspin and the load will creep past the point at which it was expected to stop. For these reasons it is recommended that loads be driven downward as slowly as practicable and that the engine should be slowed to idling speed before the clutch pedal is depressed.

5.06 The worm brake must be properly adjusted. Should the winch operator be in doubt concerning this adjustment, he should report it to his supervisor for attention of the motor vehicle maintenance forces.

## 6. POWER TAKE-OFFS

6.01 The truck engine is used as a source of power for driving the truck mounted winch. Special power take-offs known as propeller-shaft power take-offs have been designed for telephone construction trucks other than those with front mounted winches. The power take-off is located under the winch, and the propeller shaft is attached to the main shaft of the power take-off which projects from both ends of the take-off case. The main shaft is split inside the case and the two parts are connected or disconnected by means of an internal-tooth clutch arrangement. This clutch-gear has teeth on the outside which mesh with teeth on other gears mounted on the output shaft of the power take-off. The winch is driven through a silent chain connecting the sprockets on the end of the power take-off output shaft and the winch worm. Standard side opening power take-offs are usually used on trucks with front mounted winches.

6.02 The propeller-shaft power take-off is available in two forms for driving either single or double-drum winches. The design of these power-take-offs was changed in 1947 and they were recoded P and P2. The addition of the numeral 2 in the code designation indicates a dual purpose power take-off. The older types of power take-offs are designated by more letters such as P2LL, etc.

6.03 The application of the various power take-offs is described below:

(a) **PLL Power Take-off:** This is a single purpose unit and is used to drive a single-drum winch, such as the L12 or L18 winch. A feature of this power take-off is that it can be installed with the sprocket to either the front or rear, and it may be placed directly underneath or ahead of the winch, depending upon construction of the truck frame. These power take-offs are mounted independently in their own brackets which in turn are attached to a separate cross-member of the chassis frame.

(b) **P2LL Power Take-off:** This is a dual unit consisting essentially of a PLL power take-off, with a second output shaft added. This power take-off is used with double-drum winches placed in the field before the latter half of 1947. As can be seen in the figure following Paragraph 7.02 the boom line position is between the winch forward and the winch reverse positions.

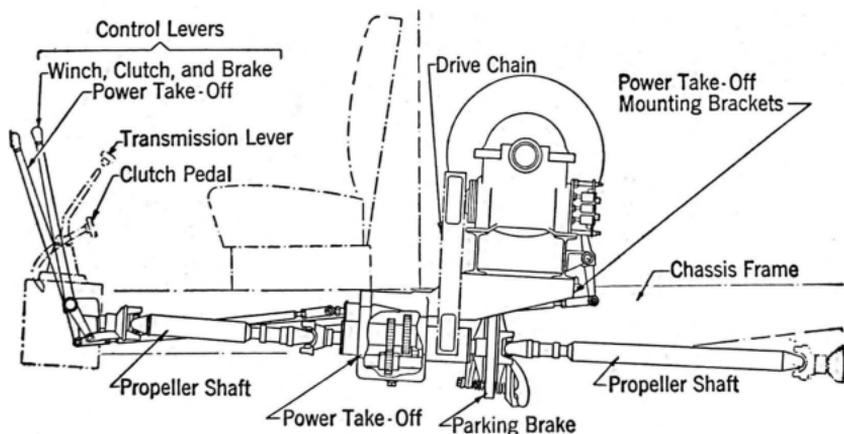
(c) **P Power Take-off:** This is the latest type of power take-off designed for use with the single-drum winches. It is mounted to form a complete unit with the winch.

(d) **P2 Power Take-off:** The P2 power take-off is a dual unit and is designed for use with the double-drum winches placed in the field after the first half of 1947. It is the same as the P power take-off except for the addition of a second output shaft. As can be seen in the lower part of the figure following Paragraph 7.02 the boom line position is at the end of the travel of the power take-off lever.

6.04 The Earth Boring Machine Winch is generally mounted on an earth boring machine truck and these trucks are usually equipped with a power take-off designed and installed by the truck manufacturer. In the case of trucks which are modified or converted from standard into all-wheel-drive units, a P2 power take-off may be used to drive the winch.

## 7. WINCH OPERATION

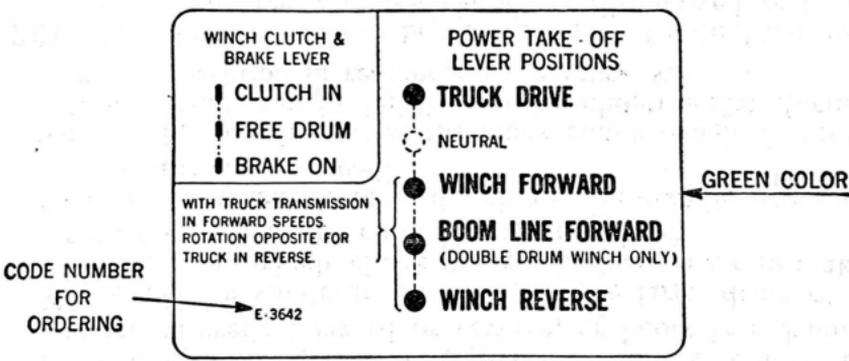
7.01 Truck mounted winches are driven by power from the truck engine, through the truck clutch, truck transmission, the power take-off and the chain connecting the power take-off and the winch worm and worm wheel. The winch is controlled by the operation of the truck clutch, and the selection, by means of the control levers, of the proper gears in transmission and power take-off to drive the winch in the direction desired, with a winch line speed suitable for the work being done (Paragraph 7.08).



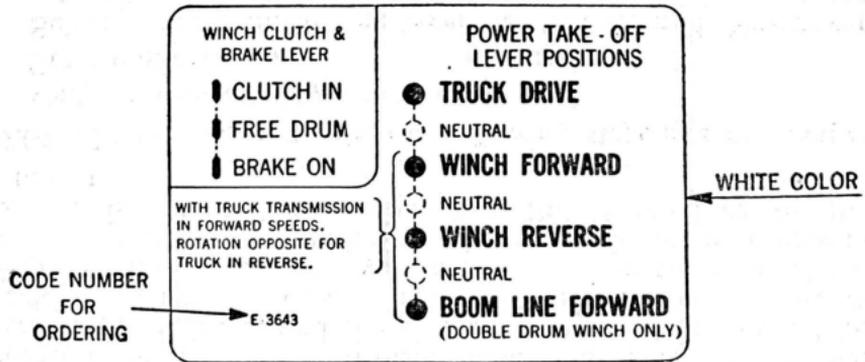
SCHMATIC OF TYPICAL PROPELLER SHAFT  
POWER TAKE-OFF AND WINCH DRIVE

7.02 The operation of the power take-off differs from the operation of the truck transmission in that the lever movement is straight through from front to rear. The lever

positions for the PLL or old type units are: Truck drive, neutral, winch forward, boom line forward (this is a neutral position on single-drum winches) and winch reverse. These are shown on the instruction card sticker printed on light green paper for the older type winches; on white paper for the new types. The position of the control lever for driving the boom line, or small winch drum on the older type double-drum winch is shown as "Boom Line Forward" between "Winch Forward" and "Winch Reverse," thus taking the place of one neutral in the PLL type. The boom line forward position for the new power take-offs is the last position in the lever's travel. Also there are neutral positions between each gear in new type power take-offs. The "Boom Line Forward" position will, of course, be disregarded if the PLL or P take-off is used. The form of the instruction card is shown in the figures below, for both old and new types of winches.



**POWER TAKE-OFF SHIFT INSTRUCTION STICKER FOR OLD TYPE POWER TAKE-OFF**



**POWER TAKE-OFF SHIFT INSTRUCTION STICKER FOR NEW TYPE POWER TAKE-OFF**

7.03 The truck operator must become familiar with the "feel" of the power-take-off just as much as the proper operation of the truck transmission. The positions of the power-take-off lever, and the clutch and brake lever should be checked against those shown on the instruction sticker. A complete knowledge of the various combinations available through proper manipulation of the transmission and power-take-off is required to realize the full capabilities of the equipment.

7.04 To operate a winch, the following steps are necessary:

Depress truck clutch pedal.

Start engine.

Select truck transmission lever position desired. Whenever possible the truck transmission lever should be used for changing speed and direction of winch rotation because it is easier to shift than it is to shift the power take-off (see Paragraphs 7.07 and 7.08).

Move power take-off lever to give direction of rotation of winch desired: forward or reverse, or boom line drum.

If operating a single-drum winch, or the large drum of a double-drum winch, check the winch clutch lever to make sure that it is in the clutch engaged position.

Release the truck clutch pedal slowly, meanwhile bringing the engine up to speed.

To stop the winch depress the truck clutch pedal. The left foot should remain lightly on the clutch pedal during winch operation in readiness for a quick stop.

7.05 To drive the small or boom line drum of a double-drum winch the truck clutch should be disengaged and the power take-off lever moved into the boom line forward position as shown on the instruction card. With the truck transmission also in a forward speed boom line winch drum will rotate forward, winding up.

7.06 To reverse the boom line drum the truck transmission should be moved into reverse gear. This is the only way the boom line drum can be driven in reverse.

7.07 The following table shows usual winch line speeds in feet per minute possible with both P and P2 power take-offs using typical truck transmission ratios. The speeds shown will vary with different truck transmission ratios depending upon the make and model of truck. The winch line speed with a full drum is about twice as fast as with an almost empty drum. The speeds given are for a half full drum and an engine speed of 1000 rpm which is a fast idle.

Transmission Position	Transmission Ratio	Winch Line Speeds in Ft. per Min.		
		Power Take-off Position		
		Winch Forward	Winch Reverse	Boom Line Forward
1	6.40	19.9	25.4	15.2
2	3.09	41.2	52.7	31.6
3	1.69	75.3	96.3	57.6
4	1.00	127.3	162.7	97.5
Reverse	7.82	(20.8)	(16.3)	12.4

Winch Reverse (Pay Out) points to the (20.8) value in the Reverse row, Winch Forward column.

Winch Forward (Pull in) points to the (16.3) value in the Reverse row, Winch Reverse column.

7.08 When choosing power take-off and transmission positions it should be remembered that when one lever is in a forward position and the other in a reverse position, the winch line will pay out and that when both levers are in either the forward or the reverse position the winch line will pull in. Whenever possible, the truck transmission should be used for shifting because a greater choice of speeds is available. If, for example, a fast pay out and slow pull in is required, it could be obtained by placing the power take-off in the winch reverse position and shifting the truck transmission into one of the forward positions, depending on the speed desired, for the pay out and to the reverse position for the pull in.

7.09 It is recommended that winches be operated in the highest transmission speed which will enable the load to be moved easily and smoothly. It is also recommended that the proper speed be selected **before starting the pull** to eliminate trouble usually resulting from attempting to shift **after** starting the pull. When lowering loads suspended from pole derricks, care should be taken to lower slowly and carefully and whenever possible engine should be slowed to idling speed before the clutch pedal is depressed.

7.10 Earth Boring Machine Winches should be operated through power take-offs on boring machine trucks in accordance with manufacturers' instructions.

7.11 The winch line drum is equipped with a combination winch clutch and brake (Paragraph 4). This is a three-position device: clutch engage, clutch disengage and brake. When the clutch is in the engaged position the winch line drum is keyed to the winch shaft. To free the drum so that it may rotate freely on its shaft, it is necessary to move the clutch lever into the clutch disengage position. This can not be done, however, if there is a load on the winch line because then the clutch is locked in place. The free drum may be braked by holding the lever in the brake position. The brake is to control the freely revolving drum so that the winch line will not pile up. **It is not designed to hold a load.** The lever will not remain in the brake position unless it is held there. When reengaging the clutch it may be necessary to have another workman pull back on the winch line (Paragraph 4.03) to permit the clutch teeth to clear and the clutch to engage. Engagement of the clutch can usually be felt in the lever and is always accompanied by a characteristic clanging sound.

## 8. MAINTENANCE

8.01 Maintenance functions of the truck operator generally will be confined to lubrication of the winch and power take-off and changing of the winch line when required. Inspection of the winch should be a continuous process during operation, with the operator being constantly alert to detect unusual sounds, excessive oil leakage, extreme heat and changes in the shifting characteristics of the winch. Information necessary to do more comprehensive maintenance work is covered in sections of the Motor Vehicle and Construction Apparatus Practices.

8.02 Troubles in the winch or power take-off should be reported through proper channels to the appropriate motor vehicle maintenance forces.

8.03 Lubrication of the winch is accomplished by placing an extreme pressure lubricant, such as Jesco #22 Lead Soap Lubricant, in the winch worm drive housing and applying grease at points where pressure gun fittings or grease cups are located in the winch.

8.04 The lubricant in the worm housings should be maintained at the level of the plug in the end of the housing, over the chain sprocket. This plug should be removed first, then the filler plug on the housing cap. Check the vent holes drilled in the filler plug to make sure they are clear. Add lubricant until it starts to run out of the level plug hole. Replace the level and filler plugs.

8.05 The winch should be lubricated and the lubricant level should be checked at least once for each week of operation.

8.06 The drive chains should be lubricated with engine oil from the inside of the chain, as required. The lubricant level in the power take-off should be checked at the time the truck transmission lubricant level is checked, and transmission oil of the same grade added to the power take-off as required.

8.07 The truck operator should closely observe the action of the winch and power take-off during operation. He should be alert to detect excessive oil leaks around the bearing cages on the worm housings, excessive heat in the housings and worm brakes, leaks in the power take-off and difficulty in shifting the power take-off and winch clutch control levers. He should note looseness in the drive chains as evidenced by chattering, and also report excessive unusual noises in the winch and power take-off.

8.08 In cold weather the clutch and brake operation may become sluggish, due to a thickened accumulation of oil. The clutch should be cleaned with kerosene to remove this accumulation.

8.09 The name-plates on winch and power take-off show the type of equipment, the serial number, the drawing list number and issue, or the parts list drawing number and assembly drawing number, the date of manufacture and the manufacturer's name and address. This information should be given on orders for repair parts in conformance with the standard procedure for ordering of repair parts. Parts names and more detailed ordering information are included in sections of the Motor Vehicle and Construction Apparatus Practices. The name-plate on the power take-off is attached to the bottom of the gear case. The winch name-plate is attached to the top flange of the I-beam closest to the cab.