# Care And Handling Of Sucker Rods

*By R. E. Berry*
*Exelson Manufacturing Co.*
*Midland, Texas*

The sucker rod manufacturers are fully cognizant of the fact that sucker rods are required to fulfill one of the most stringent tasks that is offered by today's petroleum producing program. In an effort to combat this challenge, the industry has solicited the full support of this nation's great metallurgical research capacity. However, basic steel and steel alloys are merely the initial step toward an end, and the responsibility of providing the necessary medium is entirely the responsibility of the manufacturer, and the degree of responsibility lies with each individual manufacturer. The capability, integrity and reputation of the manufacturer is entirely reflected in his eventual product.

In order to assure the petroleum producer that he is receiving, in as near perfect form as is humanly possible, a reliable producing medium, the following technique is followed by the responsible rod manufacturer:

1. One manufacturer stipulates in purchase contract that a minimum of of six 8' sample bars shall be selected from each heat of steel. These samples are then carefully tested chemically and physically in the manufacturer's laboratory in order to ascertain whether the steel heat will conform to the minimum published physical and chemical properties. If deemed satisfactory, the heat of steel is accepted for delivery and when on hand other samples are taken and tested in order to make sure that the bars actually shipped meet the same rigid specifications as the original sample test bars. Only then, and not till then, are the bars accepted for fabrication into sucker rods.

2. The rods are then mechanically straightened and inspected since a perfectly straight bar is paramount in the manufacture of a sucker rod.

3. The rods are then sheared to the correct length.

4. Upset forging of sucker rods is a truly difficult operation, due to the length of stock gathered for the upset in comparison to the diameter of the rod. Forging must be done with correctly designed dies on steel that is at exactly the proper temperature. Steel, when rolled, has a grain similar to that of wood, and like wood, its strength is much greater when the load is taken in a direction parallel with this grain. It is, therefore, necessary to upset in such a manner that this grain will deviate from a straight line as little as possible.

5. Heat treatment then follows with rods first undergoing a normalizing heat treatment to refine the steel and to remove all strains imposed during rolling, straightening and forging. Alloy rods are then heat tempered to insure the best property combinations enumerated in the normalizing process.

6. Sucker rods are next descaled to remove the thin covering of iron oxide developed through the heat treatments. Descaling exposes to the eye rolling or forking defects and permits the proper application of paint or rust inhibitors.

7. Rod threading is performed in ram-type turret lathes and consists of four operations, two roughing cuts and a finishing cut, after which a self-opening die head, particularly developed for this work, is run on the pin. The threads are thus cut to within the proper distance of the shoulder. The lathe operator continually checks the accuracy of his work with the three working gauges prescribed by API specifications. A protector is then installed on the finished thread.

8. Rods are then given a final inspection in an effort to detect surface defects, straightness defects and inaccuracies of threading. Pins are then coated with a rust preventing grease and protectors are replaced.

9. Rod couplings are then assembled with the trademarked end always

adjacent to the factory assembled pin.

10. Rods are then immersed in a rust preventive vinyl-base paint and then conveyed through an infra-red lamp bake oven.

11. Rods are then properly racked in order to preserve the straightness and in such a manner that no portion of one rod contacts another.

No chain is stronger than its weakest link and likewise no rod string is stronger than the weakest coupling. Rod couplings are manufactured as precisely and carefully as are sucker rods from thoroughly tested materials. A coupling must be tough and strong —able to resist high shock loads, vibrations and high stresses. The inner core of the coupling is allowed to remain soft and ductile and one manufacturer accurately controls the depth of penetration of the abrasion resisting outer surface through the utilization of electric induction hardening. In the thread tapping and face grinding operations, it is imperative that the coupling face is absolutely square with the axis of the coupling thread. When coupling and rod are joined, the shoulders of the pin and the end face of the coupling must be parallel. The slightest misalignment of these faces will create bending action on the pin when preloading the joint.

The rod manufacturer believes that he has one further obligation to his customer after the sale and delivery has been consummated. That obligation is that sucker rods must give the best possible and longest service—and that field men who handle these rods have adequate information on the care and handling of sucker rods.

1. When rods are shipped from the manufacturer's plant every precaution is taken to eliminate abuse. Rods are coated with a very high quality rust resistant paint. Care should be taken to maintain this coating. If it should be rubbed off, it should be replaced as quickly as possible.

2. Rods should be properly supported, at all times, and whenever lifted, to prevent any sag that would cause a permanent bend.

a. When loading for any type of transportation, rods should be carefully placed on spacers to prevent sag, with spacers between the layers of rods. API recommendations are at least four spacers with the two end spacers not over one foot from the ends of the rods. At the discretion of the customer, some manufacturers will ship carload lots of rods either in loadings of individual tiered rods or in packages containing a suitable number of rods for easy handling.

b. Spacers should be thick enough to prevent forged ends of the rods from coming in contact with those in the next layer.

3. When loading is completed, both rods and spacers should be securely anchored to prevent shifting. This is best accomplished through use of a truck with float trailer with the spacers thoroughly fastened down with tie bolts and lock nuts. When tying the load down with chains and boomers, make certain that neither the chain nor the boomer comes in contact with the rods. Permanent bends or destructive surface nicks will result.

4. Both the box and pin ends of rods are equipped with protectors to protect threads and to eliminate dirt. Trucks should be supplied with spare protectors for replacement of any lost during transportation, before the rods are unloaded.

5. Equal care should be taken during the unloading process when rods should be carefully laid down rather than dropped or pushed. A bend or nick can cause serious trouble later in rod string breakage. Careless handling of rods can cause not only the cost of replacement of the ruined rod string, but loss of production due to downtime, probable damage to well tubing and pump, and the expense of well servicing crews.

6. Permanently bent rods should not be used under any condition. Bending causes fatigue cracks and, contrary to the general belief, the grain structure of the steel at the bend cannot be restored by reheating.

7. Rods should be placed, or stored, where they cannot accumulate dirt.

8. Rods should never be placed where trucks might drive over them, where other equipment might be thrown on them, or where they might be stepped on.

For maximum good service, rods should be properly installed with due consideration given to well conditions and computed loadings. The longer the stroke, the slower the speed, since a longer stroke normally reduces the cycles per minute. The lower the cycle rate, the fewer the number of stress reversals. Stress reversals are caused by the lifting of the fluid load on the upstroke and releasing it on the downstroke.

1. The smallest bore pump, capable of producing the correct amount of fluid, should be used to reduce the weight of the fluid column on the upstroke. The rod string should be in the proper relation to the pump bore.

2. When making up new rods, they should be made up singly rather than in strings of two or three.

3. Always use the proper tools when running a rod string and make certain that elevators, wrenches and bell nipples are in perfect condition.

4. Remove thread protectors at the time of installation and not while rods are on the ground. Make certain that pins and couplings are clean and well lubricated. Do not wash with kerosene or distillate without again lubricating or the threads will gall.

5. When assembling rods make certain that the starting threads are perfectly meshed. The rods should screw together freely without forcing. If this is not the case, disengage the rods and use a tap and die on the threads.

6. It is essential that sucker rod joints be made up tight. If this is not done, the tension stress during pumping operations can cause a gap between coupling face and pin shoulder. When this happens, the couplings are free to unscrew. Further, this condition creates a fatigue action at the base of the thread on the pin and pin breaks will shortly develop. Air or hydraulically operated torque wrenches are recommended with the proper torques for the following size rods being suggested:

| *Rod Size* | *Torque* |
|---|---|
| 5/8" | 200 - 250 Ft. Lbs. |
| 3/4" | 350 - 410 Ft. Lbs. |
| 7/8" | 500 - 575 Ft. Lbs. |
| 1" | 700 - 775 Ft. Lbs. |

7. When seating the pump, caution should be used to make sure that rods are not lowered to a point where they will buckle due to the weight of the rods above them and thus create a permanent bend that could result in rod failure.

Upon completion of the pump and rod installation, it is imperative that the subsurface equipment be operated in such a manner that its life will be extended to a maximum. In order that such a condition may prevail the following operational characteristics should be maintained:

1. The speed of the prime mover should be controlled to assure smooth operation.

2. Make certain that the prime mover and pumping unit are seceurely anchored in order to eliminate vibrations and shock loads and to prevent abnormal stress on the rod string.

3. It is advisable to weigh the well to determine the proper amount of counter-balance. At the same time, length of stroke and strokes per minute can be regulated to secure the smoothest operation.

When it becomes necessary to remove the rod string and pump, the following suggested cautions should be observed:

1. Do not exert too much force on the rods in attempting to dislodge the pump. If the rods are stressed beyound the steel yield point, great damage may be done to that particular rod string.

2. It is never advisable to attempt to unscrew the rods if all joints have been properly made up and pre-loaded. In unscrewing, the rods will invariably be twisted and permanently distorted before joint can be broken.

3. When removing the rods from the well, do not strike the couplings with a hammer or similar tool in order to free the joints. Striking the coupling results in fracturing the hard case on the coupling. Then when the rods are run back into the well, coupling fatigue failures occurs. One major company has issued instructions to all operating personnel that whenever a coupling is struck it is to be immediately replaced with a new coupling. This is sound economical advice.

4. If a derrick is above the well, rods should always be suspended from a suitable hanger. However, if it is necessary to lay down the rods, the derrick girt must be slotted in order that the rods may not come in contact with the girt where bending or surface nicking will occur.

To eliminate all possible sucker rod and coupling abuse occasioned by the "human element" is the manufacturer's aim; toward such accomplishment he respectfully solicits your continued cooperation. Good judgment, exercised at all times pays handsome dividends to both oil producer and equipment manufacturer.