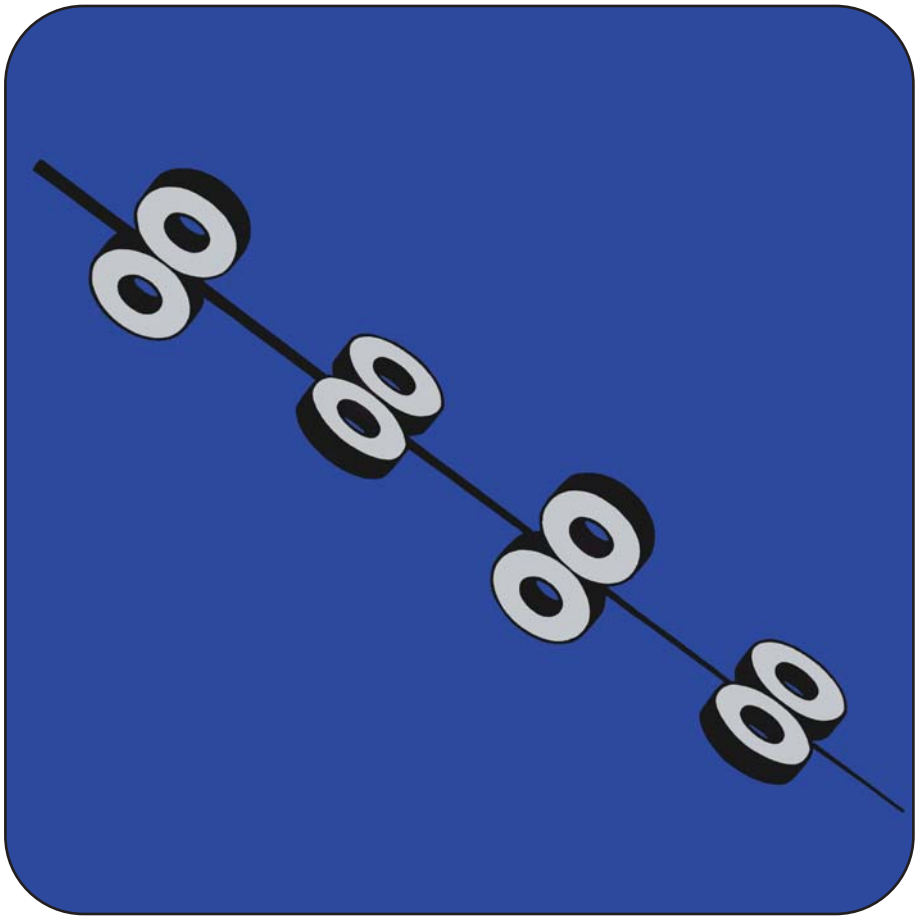
WATERBURY FARREL™

a division of

Magnum Integrated Technologies Inc.

TANDEM ROD MILLS



www.waterburyfarrel.com

Everything about a Waterbury Farrel mill is designed to help you make money.

THE NEED

Since its founding, Waterbury Farrel has encouraged its own growth by looking ahead to anticipate the needs of the metal industries it serves.

Through constant improvement of its engineering and developmental facilities, it assures its customers of rolling mill equipment that maintains the rugged reliability on which its reputation has been built, while incorporating the most modern developments in mechanical engineering and accommodating the newest trends in product design.

Waterbury Farrel's Tandem Rod Mills are of a unique design permitting a compact arrangement of a number of mills in tandem. Thus, the rod can be reduced much further in one pass than is possible by other cold rolling processes, avoiding the intermediate anneals and resulting in lower production costs.

Reduction of the rod is accomplished by passing it through a series of rolls in a mill, in which each successive housing is set at right angles to the adjacent housing. By this method, the rod can be rolled first on two corners and then of the other two corners at 90 degrees apart, permitting the rod to pass through the mill in a straight line.

ECONOMIES

Prior to the Tandem Rod Mill, rod may have been produced from a cast billet on a 2 or 3-Hi Mill, reducing it to slightly under 3/4", or it may have been a round, extruded rod of slightly larger diameter. Reduction from this point would have been by bull block, bringing the rod down to 5/16" in three or sometimes four reductions with necessary annealing and pickling between lines.

Tandem Rod Mills have the following advantages over the older process of drawing through dies:

1. Rod does not need pointing, as is necessary to start it through a die.

2. The rod can be reduced much further in one pass through the mill than possible by drawing.

3. Intermediate annealing is avoided.

4. Rolled rod, as a rule anneals at a lower temperature than drawn rod and results in better surface and grain structure.

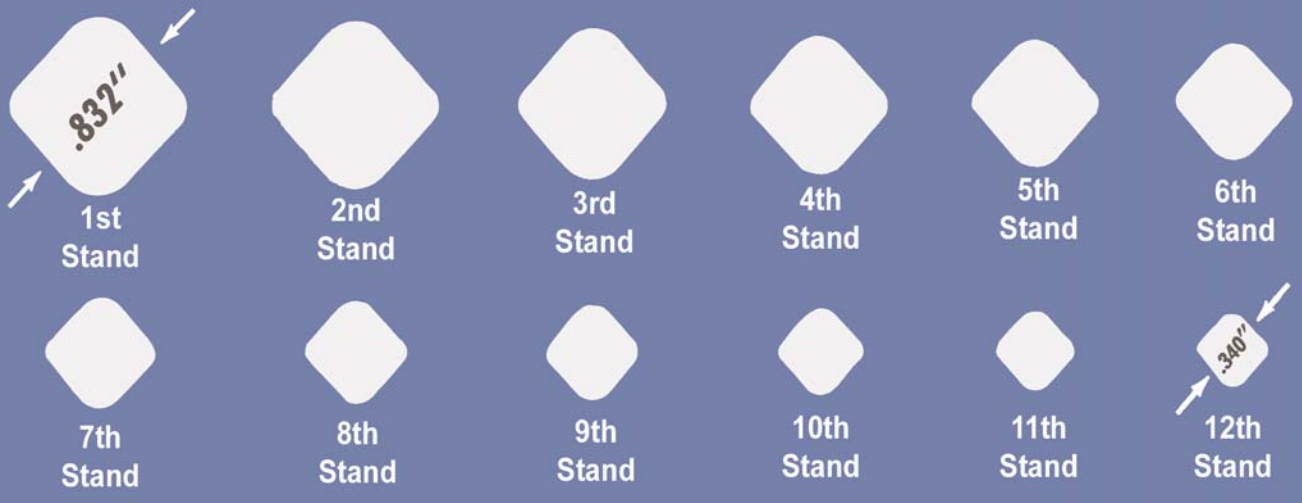
Another advantage of this process is that the rod can be reduced through this range much faster, so that the amount of rod in process at any one time is materially decreased. By reason of fewer operations and resulting saving in time, rod that required three days to process through a wire mill by the older process can now be shipped the same day that it comes into the plant. It can be seen that the savings in handling time, reduction of operations, and faster processing can only result in lower production costs.

APPLICATION

Ruggedness is a keynote applied to these mills for they handle stainless and many other ferrous alloys as well as non-ferrous material.

REDUCTION OF 1" ROUND ROD ON A 8" x 2 1/2" TWELVE STAND MILL

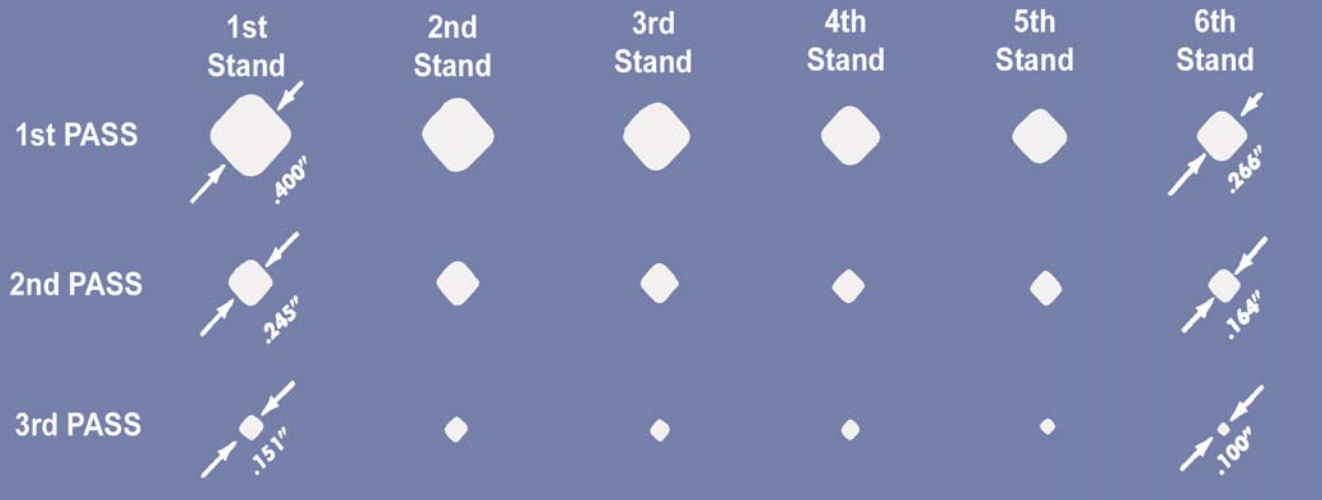
(Based on Approximate 15% Reduction on Each Stand)



4" x 2" Eight Stand Tandem Rod Mill with multiple grooves and horizontal coiler.

REDUCTION OF 7/16" ROUND ROD ON A 4" x 2" SIX STAND MILL WITH MULTIPLE GROOVES

(Based on a 15% Reduction on Each Stand)



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Even pure aluminium is easily reduced in these Tandem Mills. Aluminum alloys are also reduced by the Tandem Rod Mill process after preheating to a temperature of 600-800 degrees F. before rolling, depending on the nature of the alloys.

PAYOFF UNIT

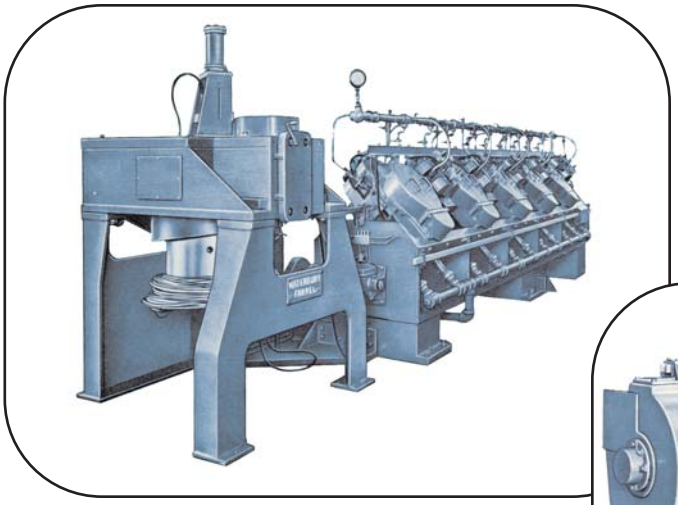
Coils of rod to be processed may be placed on a reel or payoff unit, depending upon the weight of the coil. Some payoff units we build are constructed to rotate, which will prevent scratches, marring and kinking of the rod.

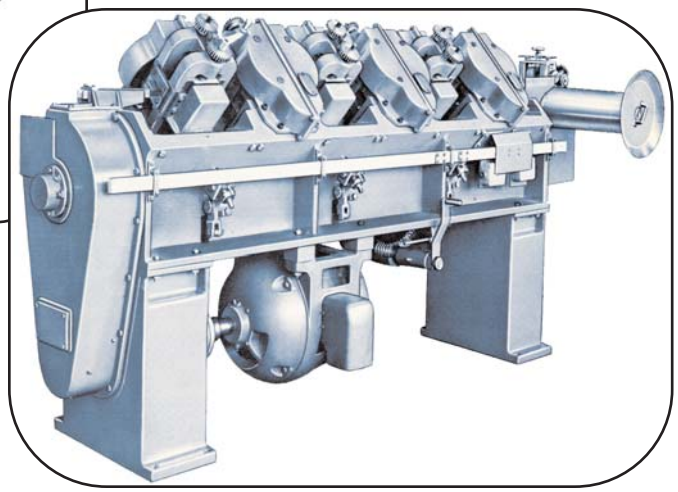
STRAIGHTENERS

Rod passing through the mill should be straightened as it comes from the coil. This eliminates the tendency of the rod to curl an makes it easier to enter the mill when handling large rod. Straighteners consist of feed and straightener rolls, driven from the main shaft in timed relation to the first reduction stand.

MILL

Most of these mills built up to the present time have a common drive shaft throughout the lenth of the machine and a fixed ratio taken from this drive shaft through to the rolls. Therefore, each pair of rolls from the entering end of the mill runs faster than the preceding set. This difference in speed is equal to the reduction percentage. Usual reduction per stand is 15% due to groove shape, but other reductions can be obtained, depending upon the material. With hardened steel gears and relatively fine pitches it is possible to figure these ratios nearly constant from which the grooves may be figured on a constant percentage reduction basis. All the rolling is done on one work line. When multiple grooves are used, the housings are moved up or down individually or simultaneously, by means of a wrench or crank. A latch dropping into place on simultaneously adjusted mills assures all housings being in alignment including the guides between stands. These guides prevent the rod from turning between stands.





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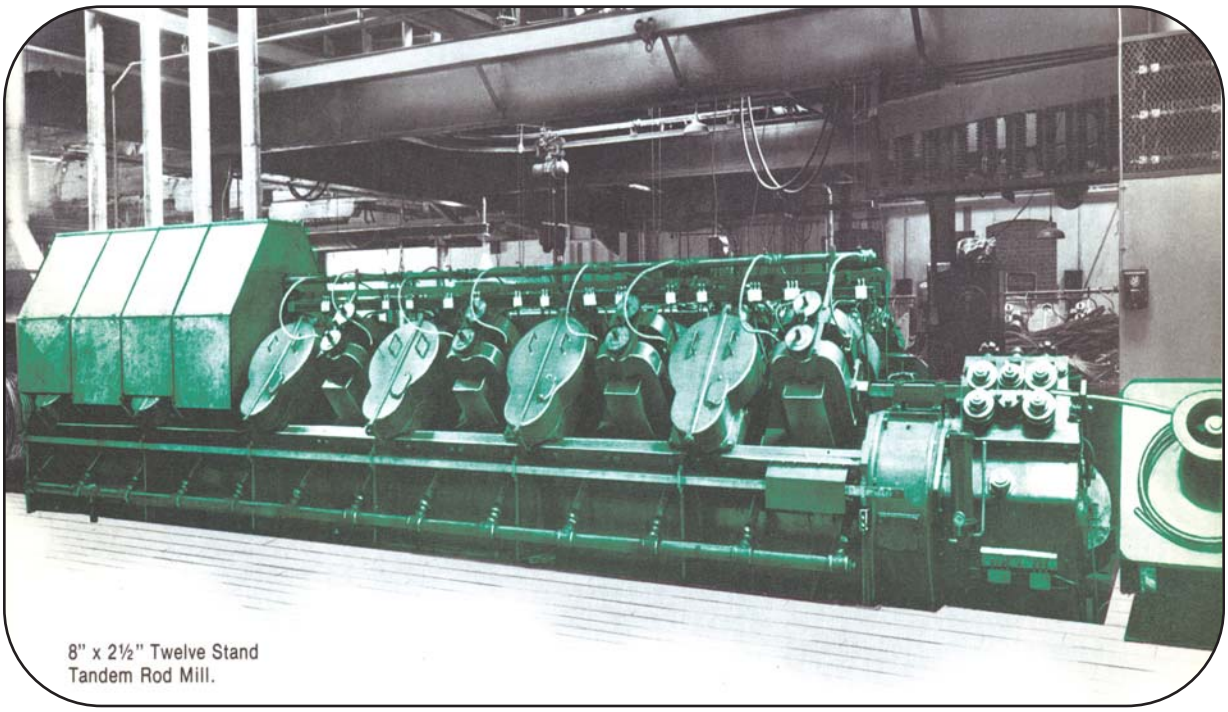
COILERS

Tandem Rod Mills are equipped with either a horizontal or vertical coiler. These coilers consist of a pair of pinch rolls, a deflecting roll, and an arbor or drum on which the coiled stock is accumulated. Horizontal coilers are usually furnished on the smaller mills for handling light-weight coils.

A vertical coiler is recommended on the larger mills. Rod is coiled in the horizontal plane by passing it around the drum and supporting the coil on radial arms at the bottom of the drum. When the coil is finished, these arms drop and allow the coil to be deposited on the floor, truck or conveyor.

Actually, the vertical coiler can be worked automatically, so that if a conveyor will carry the finished coil away, the operator does not have to be in attendance. The front of the rod coming from the mill trips a limit switch that automatically sets the radial arms into position. When the end of the rod passes this same limit switch, the arms automatically drop, depositing the coil on the conveyor and the coiler is ready for the next rod. In this way, it is possible to butt the rods together at the in going end of the mill, making for very high efficiency in rolling.



8" x 2½" Twelve Stand
Tandem Rod Mill.

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COOLANT SYSTEMS

On the smaller mills, it is generally unnecessary to cool the rolls. However, on the larger mills, temperature control becomes quite necessary. Cooling of the rolls and rod is accomplished by flooding as completely as possible with mineral oil that has been refrigerated. There is increased use of soluble oil and water coolants which are two to three times as effective as coolant, hence requiring less volume. Water soluble oil coolants are also less costly than mineral and there is some decrease in groove life due to the lesser viscosity. Coolant systems are furnished with coolant tank, pumps, filters and means of reducing coolant temperature.

CAPACITY

The following chart shows some of the sizes of Tandem Rod Mills that we have built. The dimensions are based on the mills running under normal operating conditions and with a 15% reduction at each stand.

Mill Size Dia. x Face	No. of Stands	No. of Grooves	Start Size Rd. Rod Max.	Pass No.	Finish Size Mod. Sq. Min.
4" x 2"	6	3	.437"	1	.266"
				2	.164"
				3	.100"
4" x 2"	10	1	.437"	1	.192"
6" x 2"	10	1	.625"	1	.250"
7" x 2"	10	1	.781"	1	.300"
7" x 2"	12	1	.781"	1	.256"
8" x 2 1/2"	10	1	1.000"	1	.400"
8" x 2 1/2"	12	1	1.000"	1	.340"
12" x 7"	3	3	1.250"	3	.575"

This chart shows the minimum modified square rod that can be obtained when starting with the maximum size round the mill will handle. Thus, a 1" rod extruded from a billet can be passed through the 8" x 2 1/2" 12-stand mill and be reduced to .340".

This consists of one pass without annealing between reductions. While the maximum starting size is given, rolls can be grooved to start smaller diameter rod, and finish to smaller sizes. Waterbury Farrel Tandem Rod Mills are intended to meet the ever-increasing demands placed on ferrous and non-ferrous mills. Reductions in handling time, storage space, inventory and processing time all add up to a better processing method with lower operating costs.

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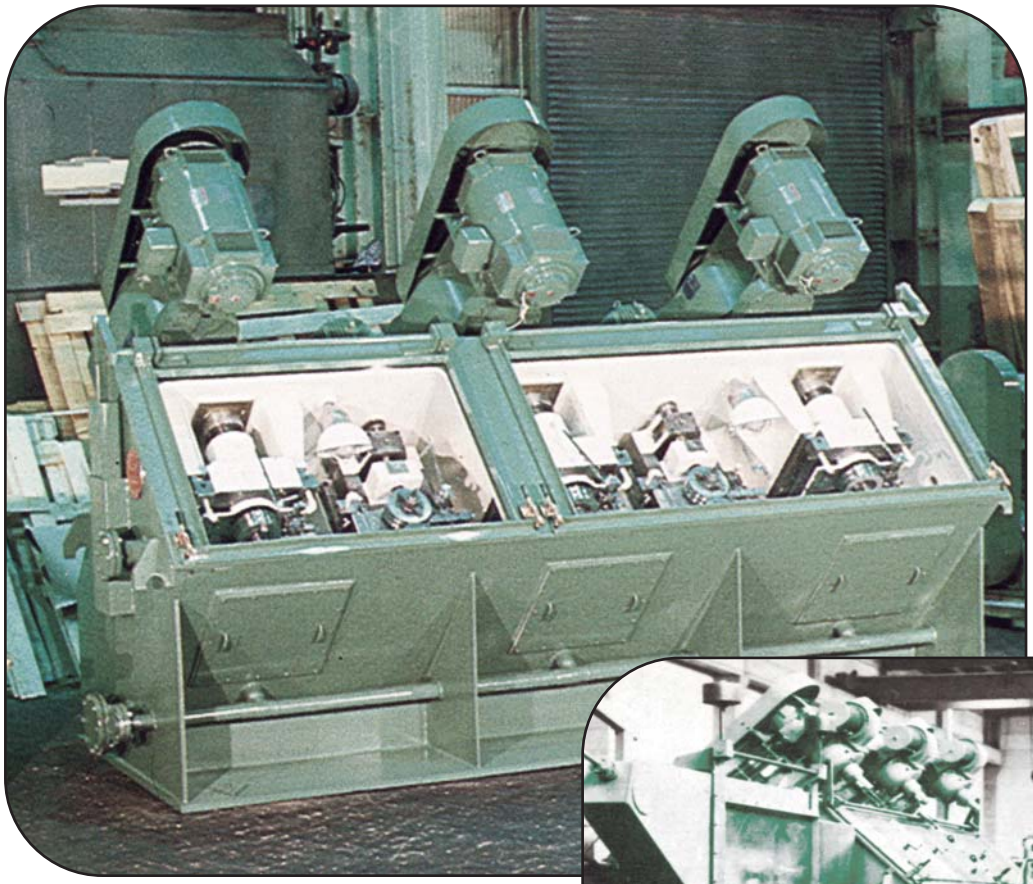
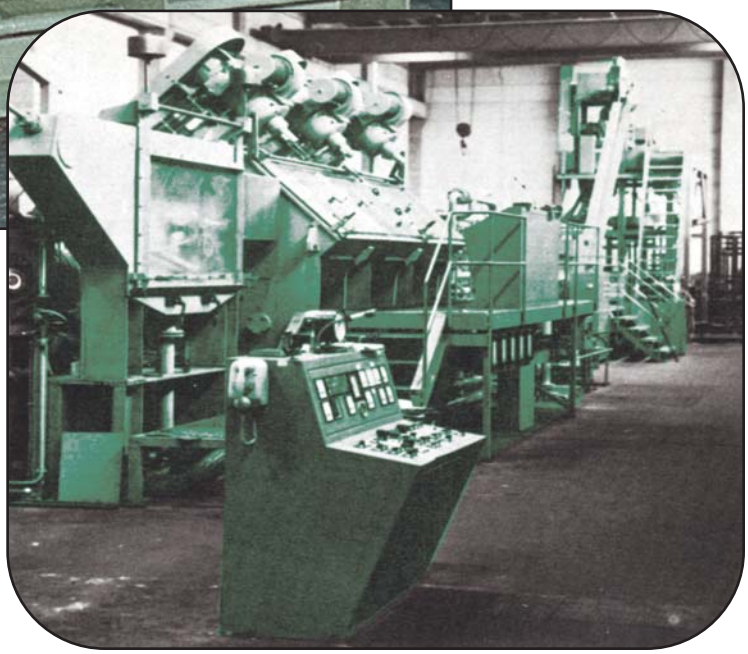
TANDEM HOT ROLLING MILL

Tandem Rod Mills are applied in continuous copper rod casting lines. This arrangement consists of tandem hot rolling mill, entry and exit speed controlling dancers, coolant system and electrical drive equipment. From caster through exit dancer, a protective rolling atmosphere is used to produce bright, oxide free rod. This mill equipment has been furnished with up to 8 stands, 2500 FPM speed, producing 12.5 MT/hour of .312" diameter redraw rod.





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This 5 Stand Tandem Rod Mill is at General Electric's Bridgeport, Connecticut plant. It is used in connection with G.E.'s patented Dip Forming process. This process consists of passing a 'core' wire or rod through a molten bath of copper wire.

When the proper combination of bath height and temperature plus speed at which the rod is passed through the bath is attained, the molten copper is picked up by the core rod at a ratio of 2 to 1.

A starting size of 9.5mm diameter rod emerges from the bath at 15.8mm diameter, is passed through a cooling tower and then through three stands of our five stand mill from which it emerges 11.1mm round.

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