MATERIAL AND EQUIPMENT STANDARD

FOR

CONVEYORS

0. INTRODUCTION

The purpose of this Standard is to establish minimum requirements for conveyors for use in petroleum industries. This Standard contains four parts as follow:

Part One: Steel Non-powered Roller Conveyors

Part Two: Chain and Belt Driven live Roller Conveyors

Part Three: Screw Conveyors

Part Four: Belt Conveyors

For each Particular inquiry the requirements of the appropriate shall be applied.

PART ONE

STEEL NON-POWERED ROLLER CONVEYORS

CONTENTS :

PAGE No.

APPENDICES:

1. SCOPE

This Standard covers general requirements including the main dimensional details and normal types of frame construction of fixed and portable "Steel Non-Powered Roller Conveyors" for use in refinery services, chemical, gas and petrochemical plants.

This Standard does not apply to precision or special purpose type of roller conveyors. Compliance by the conveyor manufacturer with the provisions of this Standard does not relieve him of the responsibility of furnishing conveyor and accessories of proper design, mechanically suited to meet guarantees at the specified service conditions.

No deviations or exceptions from this Standard shall be permitted without the written prior approval of the purchaser.

Intended deviations shall be separately listed by the Vendor and supported by reasons thereof for purchaser consideration.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor:

ASME/ANSI (AMERICAN SOCIETY OF MECHANICAL ENGINEERS / AMERICAN NATIONAL STANDARDS INSTITUTE)

B 20.1 "Safety Standard for Conveyors and Related Equipment"

CEMA (CONVEYORS EQUIPMENT MANUFACTURERS ASSOCIATION)

401-Sec. 1 "Roller Conveyors Non-Powered"

3. CONFLICTING REQUIREMENTS

In the case of conflict between documents relating to the inquiry or order, the following priority of documents shall apply:

- **First priority:** Purchase order and variations thereto.
- **Second priority:** Data sheets and drawings.
- **Third priority:** This Standard Specification.

All conflicting requirements shall be referred to the Purchaser in writing. The Purchaser will issue confirmation document if needed for clarification.

4. DEFINITIONS AND TERMINOLOGY

For the purposes of this Standard the following definitions shall apply:

4.1 Roller Conveyor

A conveyor consisting of a frame work mounting rollers freely rotatable by the passage of loads on the conveyor.

4.2 Frame Rails

Members which support the rollers.

4.3 Guards

Members attached to frame rails to form a guide to restrict the lateral movement of the package. With rollers set low, the frame acts as the guard.

4.4 Rollers

Cylindrical members with two bearings, one in each end, with outer races rotating with the member. The inner races of the bearings are mounted on a non-rotating shaft.

4.5 Bearings

This standard is constructed to cover only those bearings found in common usage in conveyor rollers. They are characterized by a single row of balls, no ball retainers, with fit and finish of a non-precision nature, consistent with their application.

4.6 Shafts

Non-rotating members which support the inner races of the bearings.

4.7 Couplings

Members used to join conveyor sections to make and integral conveyor.

4.8 Supports

Arrangement of members used to maintain the elevation or alignment of the conveyor. Supports can take the form of hangers, compression members, or brackets, and can be either stationary or portable.

4.9 Width

The dimension inside to inside of the conveyor frame rails. When auxiliary guards are required, the distance between the guards should be specified.

4.10 Grade

The amount of drop per meter required for the proper travel of the package being handled.

4.11 Curve

Section of conveyor used to change the direction of travel in an approximate horizontal plane. The curve radius is measured to the inside face of the inside frame rail. The hand of a curve is determined when facing in the direction of package travel. (See Fig. 4.1).

Curves may have either:

a) Straight face rollers (see Fig. 4.2).
b) Differential rollers (see Fig. 4.3).
c) Tapered rollers (see Fig. 4.4).

4.12 Roller Centers

Distance between center lines of adjacent shafts. For curves, detailed specification are required.

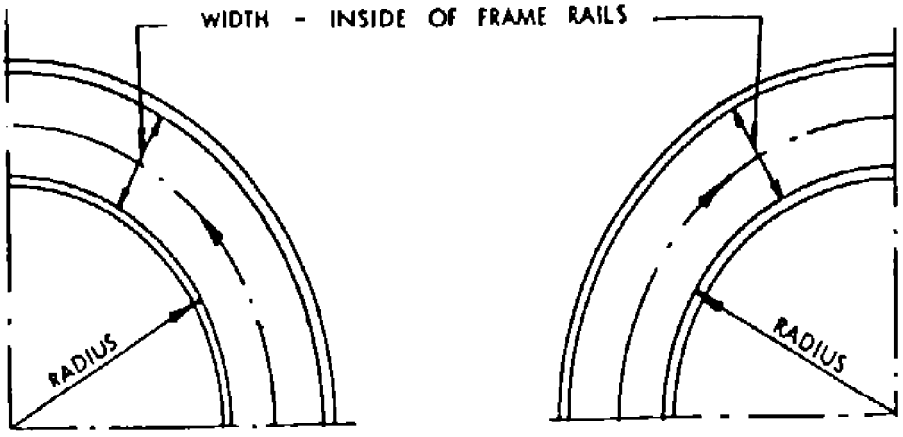
4.13 Rated Life of Bearings

The minimum number of hours at a given speed that 90% of a group of apparently identical ball bearings will function before the first evidence of fatigue develops. The "average life", which 50% of the bearings will function, will be approximately five times the "rated life".

Symbols

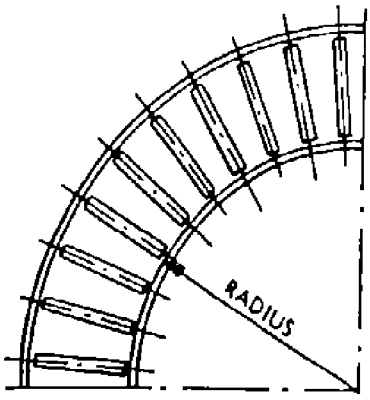
In this Standard the following symbols are used:

- d_1 diameter of roller
- d_2 diameter of shaft
- **H** height of roller track section
- **l** length of roller: nominal width of conveyor
- **L** length of frame
- **P** pitch of rollers
- **r** radius of curve

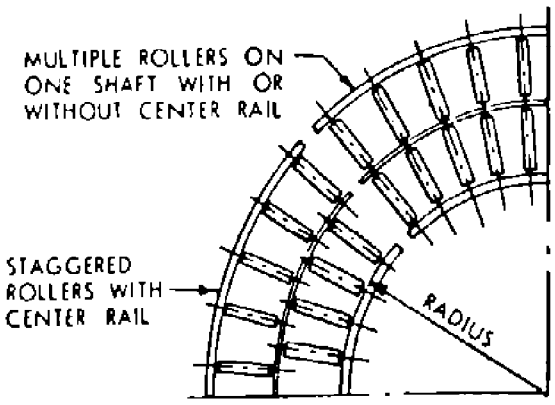


1) L.H. CURVE **R.H. CURVE**

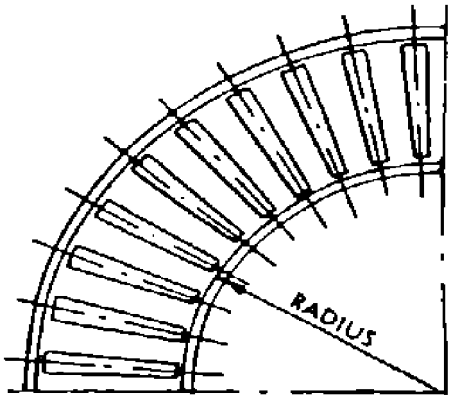
Fig. 4.1



STRAIGHT FACE ROLLERS
Fig. 4.2



DIFFERENTIAL ROLLERS
Fig. 4.3



TAPERED ROLLERS
Fig. 4.4

5. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

6. DESIGN AND CONSTRUCTION

6.1 General

Typical components of steel roller conveyors and their assemblies are illustrated, together with their designations, in Figs. 6.1, 6.2 and 6.3.

6.2 Rollers

6.2.1 Materials

Rollers shall be made of electric resistance welded (ERW) steel tube and shafts of bright mild steel.

6.2.2 Dimensions

Roller diameters shall be selected from Table 6.1. The thickness of roller tubing and the dimensions of shafts shall conform to Table 8.1. Roller lengths shall be selected from Table 6.2.

TABLE 6.1 - ROLLER DIAMETERS AND SHAFT DIMENSIONS

ROLLER DIAMETER (d_1)	THICKNESS OF ROLLER TUBING	DIAMETER OF ROUND SHAFT (d_2)	HEXAGON SHAFT ACROSS FLATS
mm	mm	mm	mm
25.4	1.2	6.5	—
38.0	1.2	10.0	9.5
51.0	1.6	10.0	9.5 12.0
57.0	1.6	10.0	9.5 12.0
63.5	3.2	16.0 20.0	15.0
76.1	3.2	16.0 20.0 22.0	17.5
88.9	5.4	25.0	25.0

TABLE 6.2 - LENGTHS OF ROLLERS (l)*

mm	300	350	400	450	600	750	900

*** The values l also denote the nominal width of conveyor.**

6.2.3 Pitch of rollers

The distance between centers of rollers is defined as "pitch" (P). The pitch on the centerline of bends is not necessarily the same as that of the adjacent straight track.

The minimum pitch on straight track depends on the diameter of roller employed. Pitches available, according to applications, are as in Table 6.3.

TABLE 6.3 - PITCHES OF ROLLERS (P)

mm	37.5	50	75	100	150	200

6.2.4 Assembly

For straight sections of conveyor, rollers shall be parallel to each other. Means shall be provided to prevent rotation of all roller shafts except where the design provides for rotating shafts secured in the rollers.

6.2.5 Roller centers

At least three rollers should be under the package, commodity or object being handled. If the weight within the package is not uniformly distributed, special consideration should be given to the roller centers.

6.2.6 Grade

The average Roller Conveyor, handling packages of a nominal size and weight, requires a grade of 42 mm per meter but this will increase or decrease according to the riding surface of the packages conveyed and their weight. On roller Conveyor sections where packages must start from rest after a lengthy dwell (such as storage systems) special consideration should be given to grade, roller centers and frame deflection.

The use of graded Roller Conveyor for handling heavy packages must be limited to short runs, otherwise brakes or other speed control devices must be added. Long unbroken runs of graded Roller Conveyor should be avoided where it is possible for one package to catch up with another and form a train.

6.2.7 Roller selection

Rollers of approximately 51 and 63.5 mm, diameter 1.6 and 3.2 mm, wall thickness are the most popular sizes, in line with general utility and cost. Smaller diameter rollers are used when close spacing is required. Larger diameter rollers are for heavy duty handling.

The required roller capacity is obtained by dividing the weight of the package by the number of rollers under the package. Roller, bearing and shaft combination of adequate capacity shall be selected according to CEMA Standard-401 Latest Edition. This selection should take into consideration that not all rollers are effective, due to manufacturing tolerances on tubing, frame rails, bearings, etc.

The length of the roller will vary according to the width of commodity conveyed. Ordinarily rollers are made 51 or 76 mm, longer than the widest package, and even more where curves are involved. In some cases packages extend beyond the end of the rollers.

6.3 Bearings

Rollers can be fitted with a variety of end bearings, the most commonly used being non-precision (uncaged) ballraces, several types of which include external seals. Other end bearings incorporate oil impregnated or nylon bushes. End bearings are constructed from (1) pressed plates, (2) machined plates retained in pressed plate enclosures, or (3) solid bar machinings. Components are hardened where necessary and although the majority have a natural finish. Anti-corrosion protection can be applied where the duty warrants this.

Bearings shall be positively located into tubes, one or more of the following methods being recommended:

1) synchronized dimpling;
2) welding;
3) peening or swaging (tube closure over bearing).

6.4 Frame Sections

6.4.1 Frame rails

Roller conveyor is normally two-rail, single-roller construction. However, multiple rail and roller combinations may be used to advantage on certain applications. The actual frame selection is generally determined by one or more of the following:

a) Actual loading on conveyor where stresses and deflection in frame members become a determining factor.
b) The nature of the commodity being handled and how the conveyor is being used.
c) What is now used for similar application.

Frames shall be of rigid construction to ensure permanent alignment of rollers and of sufficient strength to ensure that deflection under load between stands does not affect adversely the distribution of the load over the rollers or the efficient working of the conveyor. Typical arrangements of frame members are shown in Fig. 6.1.

Coupling shall be by means of hooks or joint plates.

6.4.2 Dimensions

Frame sections are normally manufactured in 2.5 m or 3.0 m lengths (L); make-up sections of shorter length are also employed where necessary. The height (H) from top of roller to underside of roller frame varies according to the design of frame.

6.4.3 Supports

The construction and spacing of supports must conform to loading on conveyor.

6.4.4 Roller curves

Roller conveyor curves are made to match any type of straight conveyor. The radius of any curve is dependent upon the length and width of the package which is to be conveyed.

Typical types of curved track are illustrated in Fig. 6.3. They are available in multiples of 30°, 45°, 60° and 90°. The overall lengths of rollers shall be selected from Table 6.2.

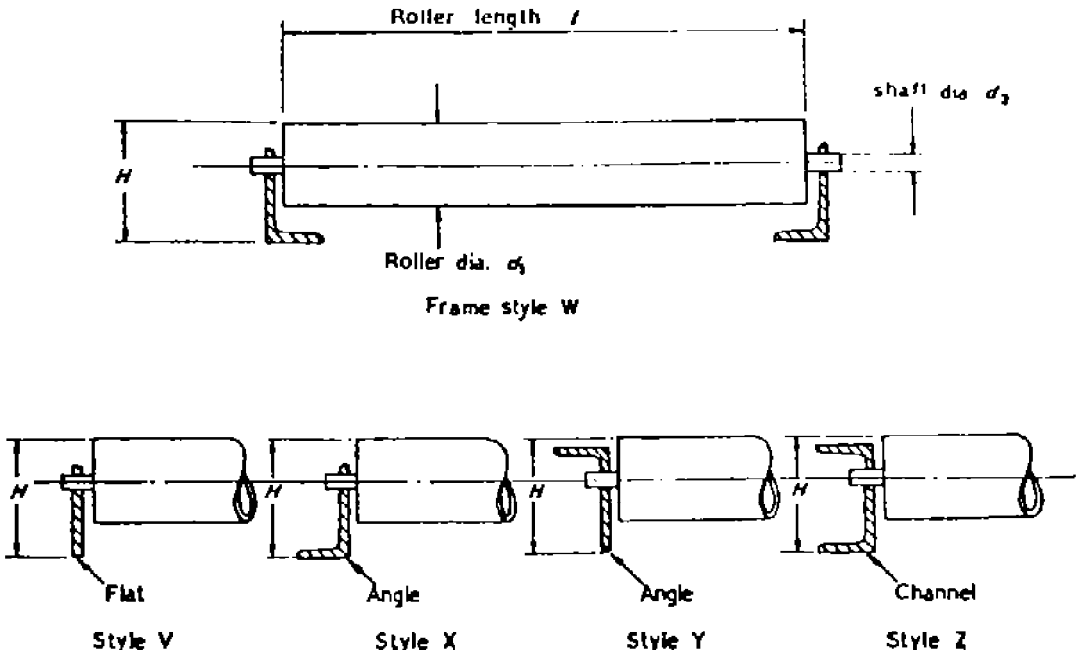
The pitch of rollers on curved sections depends upon the duty and application of the plant.

The radius (r) of the curve is measured to the inside face of the inner frame rail (see Fig. 6.3), and it is recommended that, where parallel tube rollers are used, values for r be selected from Table 6.4.

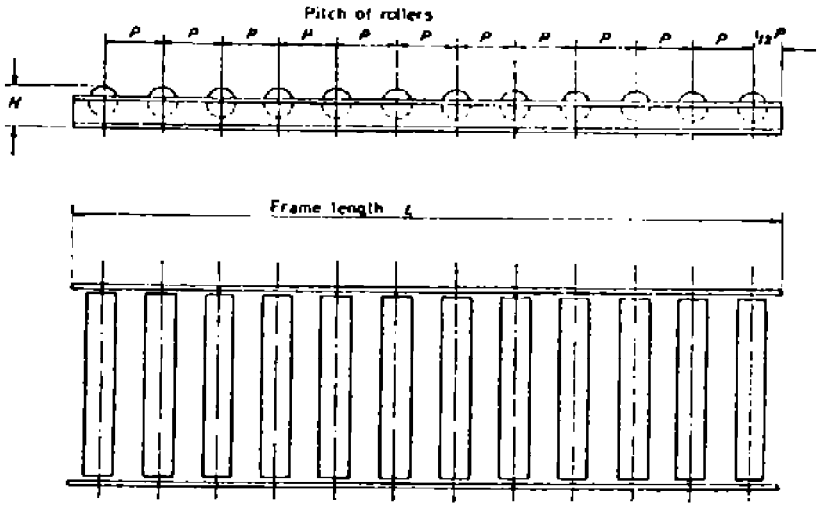
TABLE 6.4 - RADII OF CURVED TRACKS (USING PARALLEL TUBE ROLLERS)

ROLLER DIAMETER (d_1) mm	RADIUS OF CURVE (r) mm
25.4	630 800
38.0	630 800
51.0	800 1000
57.0	800 1000
63.5	800 1000
76.1	800 1000
88.9	1250

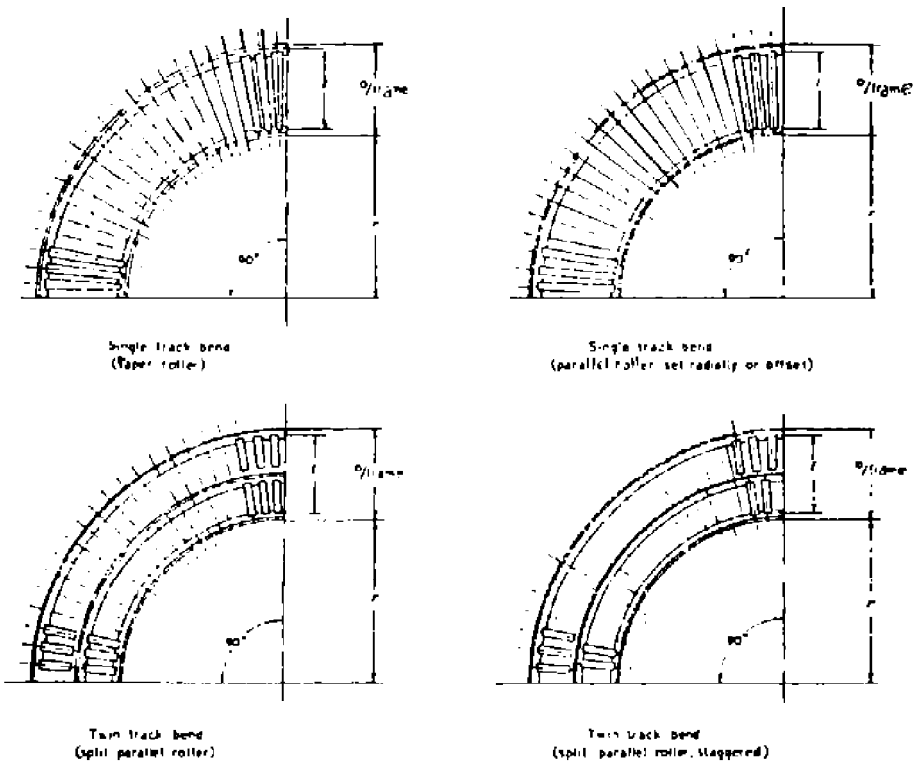
Taper tube rollers 38 mm × 57 mm diameters are available, and corresponding recommended curved track radii (r) are 800 mm and 1000 mm.



TYPICAL ARRANGEMENTS OF FRAME MEMBERS
Fig. 6.1



TYPICAL ROLLER FRAME: STRAIGHT SECTIONS
Fig. 6.2



TYPICAL ROLLER FRAME: CURVED SECTIONS
Fig. 6.3

6.4.5 Differential rollers

Differential rollers are recommended where there is a considerable variation in package size on wider conveyors. The differential action of the multiple roller construction reduces the tendency of the package to skew.

These curves may have multiple rollers on a common shaft or staggered rollers and center rail where heavier loads are handled. Auxiliary guards should normally be used. Curves require more grade than straight sections.

6.4.6 Tapered rollers

Tapered rollers are recommended over other roller curves, because they provide the best carrying surface for holding the package in the same relative position as it travels around the curve. Auxiliary guards are normally not required but are usually furnished on the outside for safety measures. Grade at the center line of the curve should be about the same as for straight sections.

6.4.7 Loading conditions

Impact encountered at loading points may require heavier frame and roller combinations.

6.4.8 Special sections

A successful roller conveyor system frequently depends on the proper accessories. Various accessories, such as spur sections, converging sections, hinged sections, gate sections, switch sections, herringbone sections, disappearing roller sections, transfer cars, turntables, rollovers, ball and caster tables and also roller spirals are available and all help to increase the versatility of a Roller System. However, it should be taken into consideration that some of the above Special Sections may require manual assistance to move material to and from the conveyor.

6.5 Guidance on Selection and Installation

6.5.1 General

In selecting and installing roller conveyor equipment account should be taken of the factors in 6.5.2 to 6.5.6.

6.5.2 Roller pitch

Under any rigid flat based load there should be full 3 roller contact as a minimum requirement. For example, a 300 mm long running surface requires rollers at 100 mm pitch; a 275 mm running surface requires rollers at 75 mm pitch.

At loading points the roller pitch may have to be reduced or special rollers provided to accommodate shock loads.

Flexible loads such as thin cardboard cartons may need a reduced pitch of roller or require wheel conveyors to prevent sagging.

Projections on the running surfaces of the load (such as binding wire, staples, straps and seams) impair the free travel of the load and might impose the full load weight on each individual roller.

6.5.3 Roller length

Rigid flat based loads can be carried on rollers of less width than the load. Cardboard cartons, rim based containers or flexible based loads should have rollers wider than the load.

The polygonal effect of loads at bends may sometimes be the controlling factor in determining the minimum width of roller required.

6.5.4 Gradient

The specification of the most satisfactory gradient and transitions between gradients for a particular application involves a number of factors, and it is accordingly recommended that reference be made to the manufacturer in this matter.

6.5.5 Track support

Tracks should be adequately supported to prevent excessive deflection under all operating conditions. A wide variety of supporting trestles, of fixed or adjustable height pattern, are available to manufacturer's standard construction. It is advisable that these are positioned under or immediately adjacent to the track section joints. The distance between trestles should be such that undue track deflection under load does not occur.

6.5.6 Environment

The manufacturer should be consulted in all cases where equipment complying with this standard is intended for use in special conditions of environment (such as in high temperatures, or in dusty, corrosive or abrasive atmospheres, or in humid or wet conditions, or on exposed sites).

6.6 Information to be Exchanged Between the Manufacturer and the Purchaser

All information regarding the conditions under which the equipment is to be used, together with the information indicated in Appendix A, should be supplied with the inquiry or order. The manufacturer shall supply the information listed in Appendix B when tendering. Vendor shall supply information and drawings listed in Appendix C after receipt of order.

7. SAFETY

Steel Non-powered roller conveyors shall be designed with safety provisions for the protection of operating personnel in accordance with ASME/ANSI B 20.1 safety standard for conveyors and related equipment, latest edition.

8. INSPECTION AND TESTING

The conveyors completed in the fabrication shop and/or field assembled shall be subjected to the visual and dimensional check of assemblies.

9. PREPARATION FOR SHIPMENT

9.1 Equipment shall be suitably prepared for the type of shipment specified. The preparation shall be mutually agreed upon and, unless otherwise specified, shall make the equipment suitable for 2 years of outdoor storage from the time of shipment.

9.2 The Vendor shall provide the Purchaser with the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the job site and before start-up.

9.3 One copy of the manufacturer's standard installation instructions shall be packed and shipped with the equipment.

9.4 Each part of the conveyor shall be affixed with a metal tag, indicating its name and part number to facilitate conveyor assembling.

9.5 Unless specified otherwise, separate shipment of the equipment is not allowed.

10. GUARANTEE AND WARRANTY

Unless exception is recorded by the Vendor in his proposal, it shall be understood that the Vendor agrees to the following guarantee and warranties:

During a period of 12 months after the date of commissioning, the Vendor shall, with all possible speed and without cost to the Purchaser, replace or repair the goods or any part thereof found to be defective due to faulty material, workmanship or to any act or omission of the Vendor. In the particular the Vendor shall reimburse any transportation and other charges incurred by the Purchaser in effecting such replacement or repair at the point of use.

APPENDICES

APPENDIX A
INFORMATION TO BE SUPPLIED WITH INQUIRY OR ORDER (see Par. 6.6)

The following particulars will enable the manufacturer to select the most suitable equipment from his production range to suit the proposed application:

1) Maximum and minimum sizes of loads* in millimeters
2) Maximum and minimum weights of loads in kilograms
3) Particulars of running surface if not flat and rigid
4) Any special operational conditions (see 6.5.6)
5) Whether fixed or adjustable stands are required
6) Maximum accumulating load per 2.5 m length, or 3 m length, in kilograms
7) Conditions of loading, i.e. single load travel or batching
8) Details of any impact loading, including its location, i.e. locally or continuously along the track
9) If possible, a sketch of the proposed layout, with such details as available clearance heights

*** First dimension given to be that of the leading edge normal to the direction of travel.**

APPENDIX B

INFORMATION TO BE SUPPLIED BY THE MANUFACTURER (see Par. 6.6)

1) Maximum and minimum sizes of loads* in millimeters
2) Maximum and minimum weights of loads in kilograms
3) Maximum accumulating load capability per 2.5 m length, or 3.0 m length, in kilograms
4) **Rollers**

   a) Length in millimeters
   b) Diameter in millimeters
   c) Pitch in millimeters
   d) Thickness of tube in millimeters
   e) Spindle size in millimeters
   f) Type of bearing (including sealing arrangement if applicable)
   g) Method of retaining spindle in frame

5) **Track**

   a) Type and arrangement of frame members
   b) Length in meters
   c) Overall width in millimeters
   d) Height from bottom of track to top of roller in millimeters

6) **Connections:** Type of coupling between track sections
7) **Stands**

   a) Type
   b) Fixed (with fixing details) or free standing
   c) Pitch in meters

8) **Guard rails**

   a) Type
   b) Overall height from top of rollers in millimeters

*** First dimension given to be that of the leading edge normal to the direction of travel.**

APPENDIX C
VENDOR DATA REQUIREMENTS AFTER RECEIPT OF ORDER (see Par. 6.6)

Vendor shall furnish the following data in the number of copies and in the number of calendar days agreed upon by the purchaser after receipt of order. Certified data shall be submitted within thirty (30) calendar days after return of approved data.

1) Equipment general arrangement DWG
2) Outline dimensions
3) Cross section
4) Foundation layout, anchor bolt details, etc.
5) Erection drawings, & diagrams
6) Bill of materials
7) Complete part list
8) Recommended spare parts for 2 years operation
9) Recommended spare parts for commissioning
10) Instructions-installation, operation, and maintenance manual as requested

PART TWO

CHAIN AND BELT DRIVEN LIVE ROLLER CONVEYORS

CONTENTS :

PAGE No.

APPENDICES:

1. SCOPE

This Standard covers minimum requirements for chain and belt driven live roller conveyors including roller and transmission chain and sprockets for use in refinery services, chemical, gas and petrochemical plants and where applicable in production and new ventures.

Compliance by the conveyor manufacturer with the provisions of this Standard does not relieve him of the responsibility of furnishing conveyor and accessories of proper design, mechanically suited to meet guarantees at the specified service conditions.

No deviations or exceptions from this Standard shall be permitted without the written prior approval of the Purchaser.

Intended deviations shall be separately listed by the Vendor and supported by reasons thereof for Purchaser consideration.

2. REFERENCES

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ANSI (AMERICAN NATIONAL STANDARD INSTITUTE)

B 20.1 "Safety Standard for Conveyors and Related Equipments"
B 29.1 "Precision Power Transmission Roller Chain Attachments and Sprockets"

IPS (IRANIAN PETROLEUM STANDARDS)

E-GN-100 "Units"
M-GM-210, Volume 1 "Non-Powered Roller Conveyors"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

D 181-42 "Standard Specifications and Methods of Test for Certain Heavy Cotton Fabrics for Manufacture of Hose and Belting"

D 413-39 "Standard Methods of Test for Adhesion of Vulcanized Rubber (Friction Test)"

D 378-60 "Standard Methods of Testing Flat Rubber Belting"

D 430-59 "Standard Methods of Dynamic Testing for Ply Separation and Cracking of Rubber 'Products"

3. CONFLICTING REQUIREMENTS

In the case of conflict between documents relating to the inquiry or order, the following priority of documents shall apply:

- **First priority:** Purchase order and variations thereto.
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All conflicting requirements shall be referred to the Purchaser in writing. The Purchaser will issue confirmation document if needed for clarification.

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

5. DEFINITIONS AND TERMINOLOGY

5.1 Chain or Belt Driven Live Roller Conveyors

Conveyors which use a roller bed for the carring surface. The unit load ride directly upon the roller surface, and the rollers are driven by chains and sprockets and/or for belt driven by belts and pulleys.

5.2 Roller

A cylindrical member with internal bearings mounted on a non-rotating shaft. Rollers with live shafts and outboard bearings can also be used and may be required at the drives.

5.3 Conveyor Bed

The carring rollers which support the load while being conveyed.

5.4 Conveyor Width

The dimension between the inside of one frame member and the chain guard for chain driven, (see Figs. 5.1.a, 5.1.b, 5.1.c) and the dimension inside to inside of frame rails for belt driven conveyors. (See dimension A Figs. 5.2.a, b, c.)

5.5 Chain

A series of links pivotally joined together to form a medium for conveying or transmitting motion or power.

5.6 Sprocket

A wheel with shaped teeth, regularly spaced on the rim to engage the links of a chain.

5.7 Drive

An assembly of mechanical, electrical and structural parts to provide motive power.

5.8 Take-Up

An adjustable sprocket to compensate for change in chain length and/or belt length due to wear. Adjustment is usually manual and for chain driven is employed on continuous chain drive only.

5.9 Fill-In Plates

Close fitted plates positioned between the rollers.

5.10 Horizontal Curve

A powered roller conveyor section used to change the direction of travel.

5.11 Pulley

A cylindrical member, mounted on a revolving shaft with or without a crowned face.

5.12 Roller or Idler

A cylindrical member with internal bearings mounted on a non-rotating shaft.

5.13 Pressure Roller

The roller used for holding the driving belt in contact with the load-carrying rollers.

5.14 Guide Roller

Roller used to guide or confine the belt to the defined path by contact with the edge of the belt.

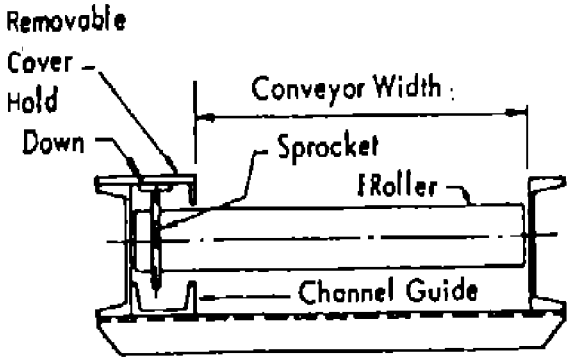
5.15 Snub Roller

Roller or pulley located adjacent to the driving pulley to provide a greater degree of belt wrap.

5.16 Pop Out Roller

A special load-carrying roller mounted in such a manner as to pop out when foreign objects are introduced between the belt and the roller.

TYPICAL CROSS SECTIONS



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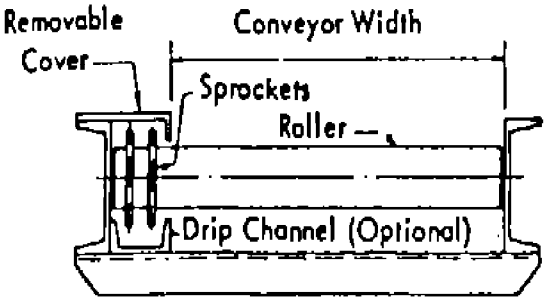

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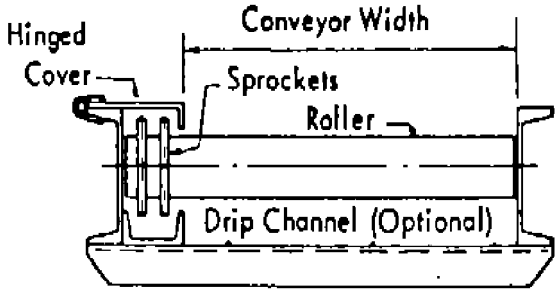

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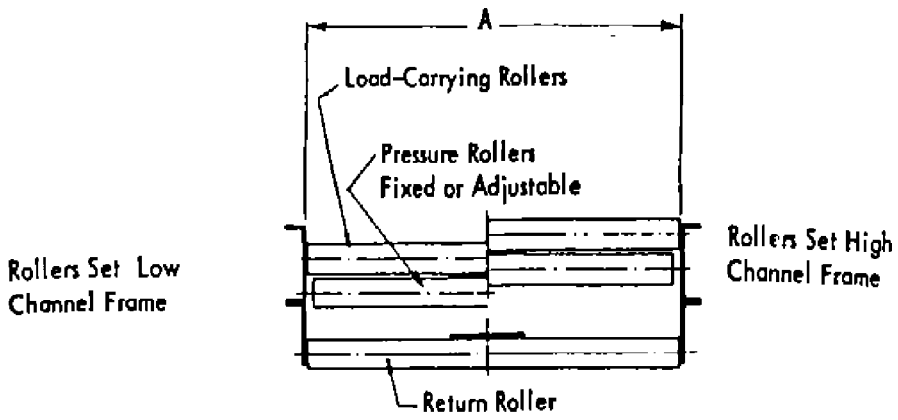
Fig. 5.1

TYPICAL CROSS SECTIONS



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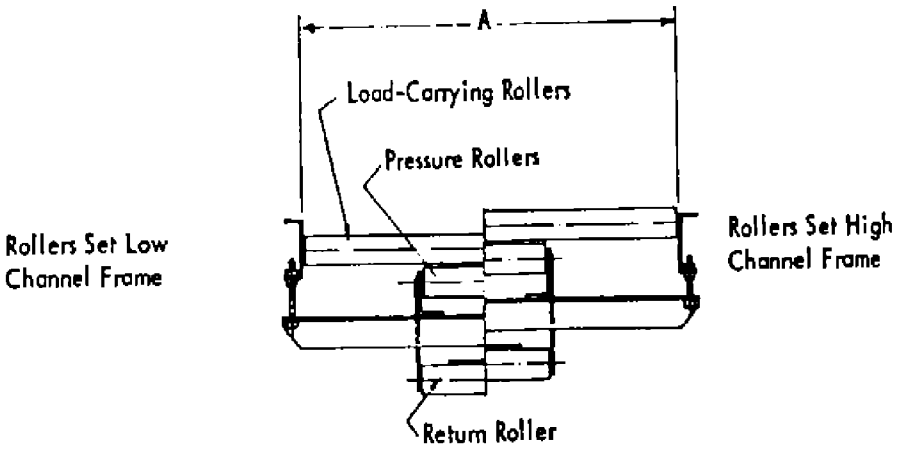

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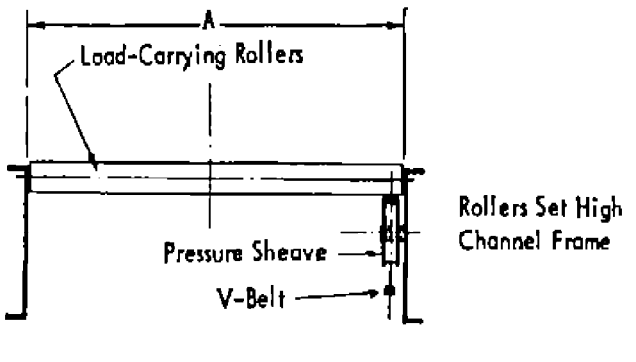

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Fig. 5.2

6. DESIGN AND CONSTRUCTION

6.1 General

Chain driven live roller conveyors are used to carry loads at controlled speeds. They are better suited than belt driven live roller conveyors in applications where heat, dirt, oil, grease and other contaminants are present. The driving chain or chains are at one end of the rollers and can be shielded and guarded.

Two types of chain driven live roller conveyors are considered:

a) Continuous chain type (Figs. 6.2.a and 6.2.b)
b) Roller-to-Roller type (Figs. 6.3.a and 6.3.b)

The continuous chain type has the lower initial cost. It consists of a single strand of chain traveling over sprockets welded to the rollers (Figs. 6.1.c and d). Contact with the sprocket teeth is maintained by a continuous cover plate and holddown. The chain is returned in a channel guide or over sprocket idlers. This type should not be used for start-stop applications, and only with moderate unit loads. When rollers on close centers are required, a double width chain with staggered sprockets is used (Fig. 6.10).

In the roller to roller type of construction, two plate sprockets are welded to each roller, and individual loops of chain connect pairs of rollers in a staggered pattern, along the length of the conveyor (Figs. 6.3.c and 6.3.d). This driving arrangement is more desirable for heavy loads and for applications requiring frequent stopping or reversing service. However, it is more expensive and requires additional power.

Belt driven live roller conveyors can be operated at the speed best suited for the work being performed. They are normally used where packages are allowed to accumulate causing blocked line conditions, but can also be used as a pacesetter for assembly operations, for transportation or as a timing medium for integrated handling systems.

Purchaser shall specify type of conveyor. Use of belt driven conveyors shall be subjected to explicit approval of the Company.

6.2 Conveyor Bed

There should be a minimum of three rollers supporting the shortest load, with at least two being driven. This may allow the use of one or more idler rollers between the powered rollers, resulting in a saving in cost and power requirements. When idler rollers are used, wear bands may be required to prevent the drive chain from cutting into the roller. The use of bands depends upon the difference in roller and sprocket diameters and the spacing of the driven rollers (Fig. 6.3.d).

Reduced pressure type (rock tooth) sprockets should be used on continuous chain driven live roller conveyor where tangential contact occurs.

6.3 Speed and Load

The number of unit loads a chain driven live roller conveyor will handle is determined by its speed and the package spacing. The size and weight of the package governs the frame and roller construction. (See Clause 6 - Part One Steel Non-powered Roller Conveyors.) For a given delivery rate, the speed should be as high as practical so that the loads are spaced further apart, thus reducing the working tension of the chain.

6.4 Inclined Conveyors

Inclined belt and chain driven live roller conveyors are used to make minor changes in the elevations between the load and the discharge ends. All rollers should be driven on inclined conveyors. Inclined conveyors should not be used for accumulation.

6.5 Slope

With packages having good firm bottoms, the maximum incline should not exceed 5 degrees; however, on declining conveyors, the slope can be slightly greater.

6.6 Take-Ups

Take-Ups are required only on continuous type chain driven and on all belt driven live roller conveyors to compensate for changes in belt length and to maintain belt tension. Take-up devices may be located at any point along the return run of the belt after the drive or at the tail pulley. The most desirable take-up location is immediately following the drive. See Figs. 6.1.a through 6.1.d for typical side elevations.

Take-ups should be designed to provide a movement of at least one percent of the conveyor length measured between end pulleys with a travel of 50 mm as a minimum.

On all automatic take-ups, except vertical type, some mechanical device is desirable to keep the take-up pulley square with the axis of the belt. A device frequently employed is a squaring shaft, which forces both take-up shaft bearings to travel on equal amount.

6.7 Drive Arrangement

There are many variations in drive arrangements. A gearmotor is the most common type. The output shaft of this unit is connected to the head or drive shaft by a chain drive or flexible coupling. A motor and reducer are sometimes used.

When variable speed is required, a mechanical speed-changer is generally used between the motor and the reducer.

Important considerations in the design of belt driven live roller conveyor are pulley lagging and the angle of belt wrap. Lagging increases the lift of the belt and machinery by reducing belt tension. Snub idlers or pulleys are used to increase the angle of wrap.

On roller-to-roller type chain driven live roller conveyor, it is recommended that the drive unit be located near the center of the conveyor to keep the chain pull to a minimum (Fig. 6.2.a). On short conveyors, end drives may be used (Fig. 6.2.b).

6.8 Supports

The same type of supports are used for chain driven and belt driven live roller conveyors as for roller conveyor. Support spacing is dependent on the loading and, in some cases, on the building construction. Supports must be spaced to limit frame deflection (see Clause 6.4 Part 1). The frame for supporting the machinery components of the conveyor shall be designed in accordance with AISC Standard.

6.9 Deflectors

Deflectors are not recommended for heavy loads. There are a number of different types of deflectors in use, the simplest being straight or curved bars set at an angle to the direction of travel to move the package to one side as it slides along the bar. These bars may be faced with special friction reducing materials. They are sometimes lined with closely spaced ball bearing wheels. Another type employs a motor driven flat or V-belt set in a vertical plane and backed-up by a supporting structure. The moving belt causes the package to discharge positively from the conveyor.

The deflectors may be made removable by mounting on vertical pins or may be hinged on vertical shafts. Control may be provided by hand levers or remotely by means of air cylinders, gear motors or other devices.

6.10 Transfers

Various types of transfers are used; the most common types for chain driven are:

1) Gravity roller curve-used at ends of conveyor
2) Disappearing gravity roller section (Fig. 6.4)
3) Disappearing roller section with pusher
4) Cross chain conveyor (Fig. 6.5):
   a) may be raised,
   b) main conveyor may be depressed,
5) Disappearing stop with pusher.

For belt driven live roller conveyor the most common type is the gravity curve, either roller or wheel type.

For intermediate receiving or feeding, a spur section of roller or wheel conveyor is used at an angle of approximately 30 degrees to the direction of travel of the through conveyor. The tapered portion of the transfer is fitted with varying length rollers or with a series of wheels or casters. The rollers in this section may also be power driven.

The simplest form of power transfer is the right angle one, where the feed line is brought in at a right angle to the main line and a turning post or roller is used to assist the package in negotiating the turn, see Fig. 6.8.c. Such an arrangement works very well if there is always sufficient space between packages to permit one to negotiate the turn before the next package arrives.

6.11 Horizontal Curves

Horizontal curves can be powered by a continuous chain or by the roller-to-roller method. On continuous chain curves (Fig. 6.6.a) the sprockets are mounted on either end of the rollers, depending on the diameter and spacing of the rollers (Figs. 6.6.b and 6.6.c). A special flexible chain with thin, rack tooth sprockets should be used on the continuous chain curve.

On the roller-to-roller type, the sprockets are mounted on the outside end of the rollers (Fig. 6.7.a). Because the chain acts as the chord of a circle, it is not in line with its sprockets, making it important that the angularity be controlled. The controlling factors are:

1) The angular spacing between the rollers, usually limited to 3 degrees.
2) The radius of the outside rail.
3) Center distance of rollers on outside rail.

These factors should be selected so there will be no more clearance than necessary between the sprockets. This condition will improve the operation because it minimizes the rubbing of the chain side links against the sprocket teeth. Standard chain and thin sprockets with regular teeth are used on the roller-to roller drive.

Belt driven live roller curves with straight face or tapered rollers are made up to 180 degrees (See Fig. 6.9) Special curves can be made for any degree required with or without tangents on ends.

Curves are generally driven by V-belt or similar type belt. They are powered separately or from connecting conveyors, and can be reversible.

6.12 Specific Definitions for Belting

6.12.1 Carcass

The fabric reinforcing section of a belt as distinguished from the cover.

6.12.2 Duck

A term applied to a wide range of medium and heavy weight fabrics, commonly made of cotton.

6.12.3 Friction

A rubber adhesive compound applied to and impregnating a fabric usually by means of a calendar with rolls running at different surface speeds, hence the name "Friction". The process is called "Frictioning".

6.12.4 Ply

A single layer of fabric.

6.12.5 Skim or skim coat

A layer of rubber material laid on a fabric but not forced into the weave. Normally laid onto a frictioned fabric. Generally used between plies of a carcass to increase resistance to flexing failure particularly over small pulleys.

6.12.6 Covers

The outer covering usually intended for protection.

6.12.7 Raw edge

The uncovered square edge of a belt created by cutting after vulcanization.

6.12.8 Cemented edge

An application of rubber cement or other edge sealant over the raw or cut edge of a belt.

6.12.9 Folded edge

A belt construction wherein an outer ply is folded around a carcass so as to cover the edges.

6.12.10 Mechanical splice

A joint made by fastening two ends of belting together by means of metal hooks which are clinched thru the belt.

6.12.11 Vulcanized splice

A joint made endless by means of vulcanizing together two properly prepared ends of the belt. Within the above definitions, the belting is normally one of the following general types:

1) Stitchedcanvas

Separate plies of fabrics (usually cotton duck) are stitched together and normally treated by immersion in special compounds.

2) Impregnated, friction surface

A compounded elastomeric material is used to surface or impregnate the plies of fabric and bond them together.

3) Covered

A carcass of friction surface belt covered on one or both sides with rubber or other elastomeric material.

4) V Belt

A belt with a cross section in the general shape of a trapezoid. Made of vulcanized rubber with internal reinforcing.

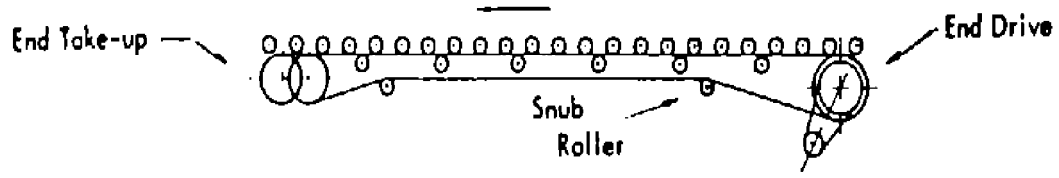
5) Ripple belt

A special belt with raised pads spaced at uniform intervals along its length. Only the pad surface contacts the load carrying rollers.

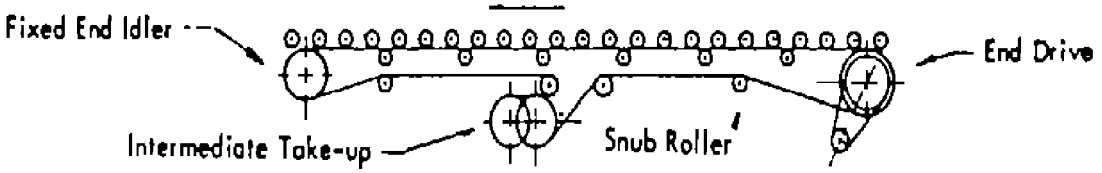
Specifications and testing methods for various belting materials can be found in one of the following references:

ASTM D 181-42
ASTM D 413-39
ASTM D 378-60
ASTM D 430-59

LEVEL BELT DRIVEN LIVE ROLLER CONVEYORS TYPICAL SIDE ELEVATIONS



(a)



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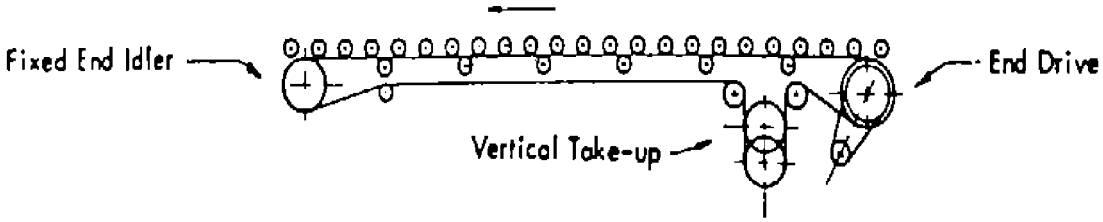

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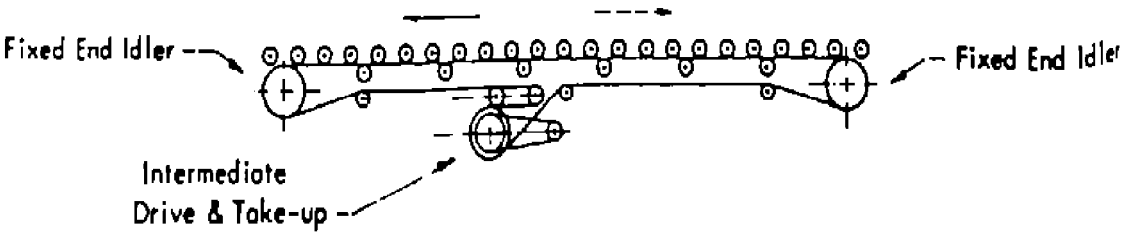


Fig. 6.1

CONTINUOUS CHAIN DRIVEN LIVE ROLLER CONVEYOR

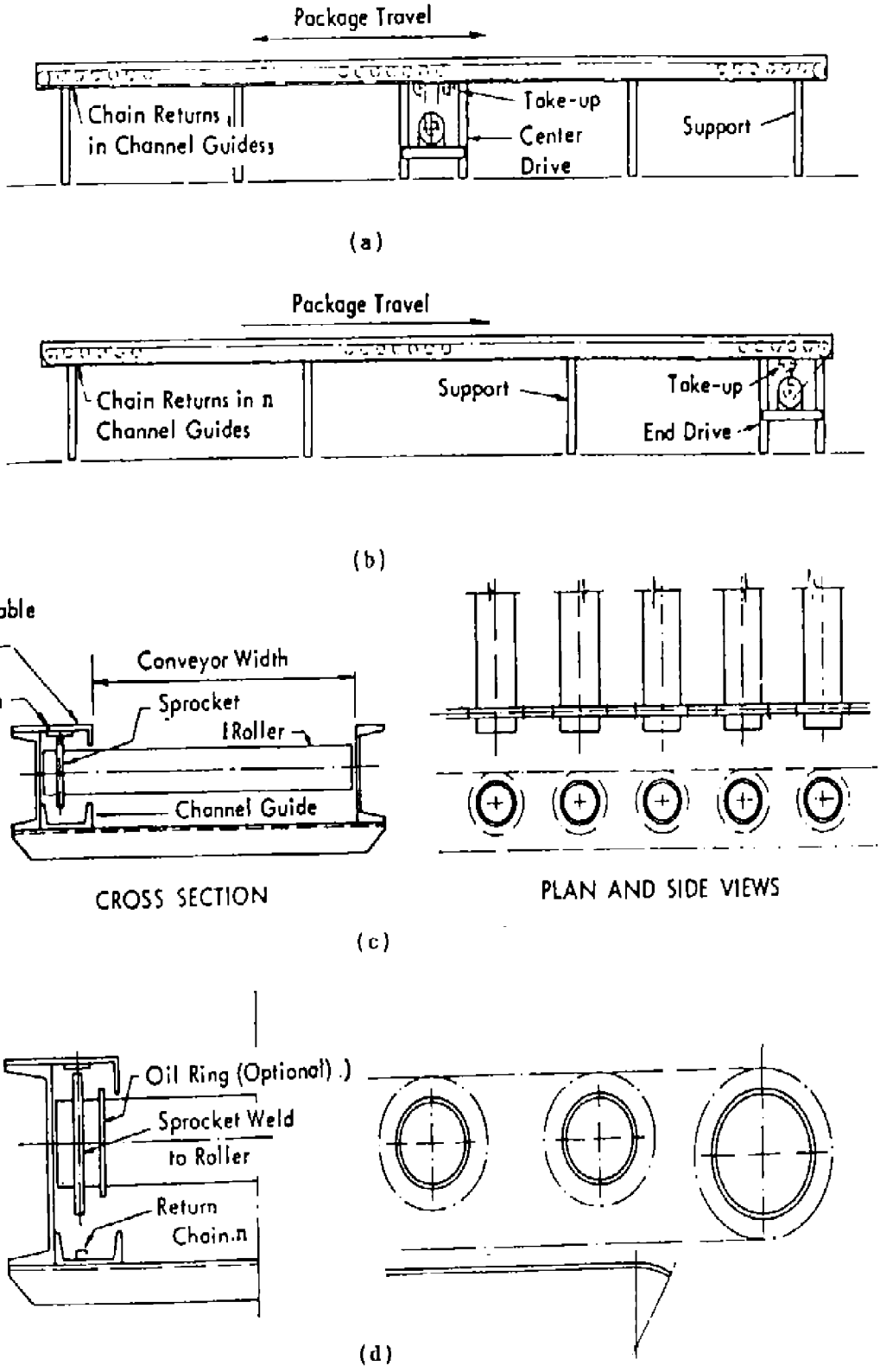


Fig. 6.2

ROLLER TO ROLLER CHAIN DRIVEN LINE ROLLER CONVEYOR

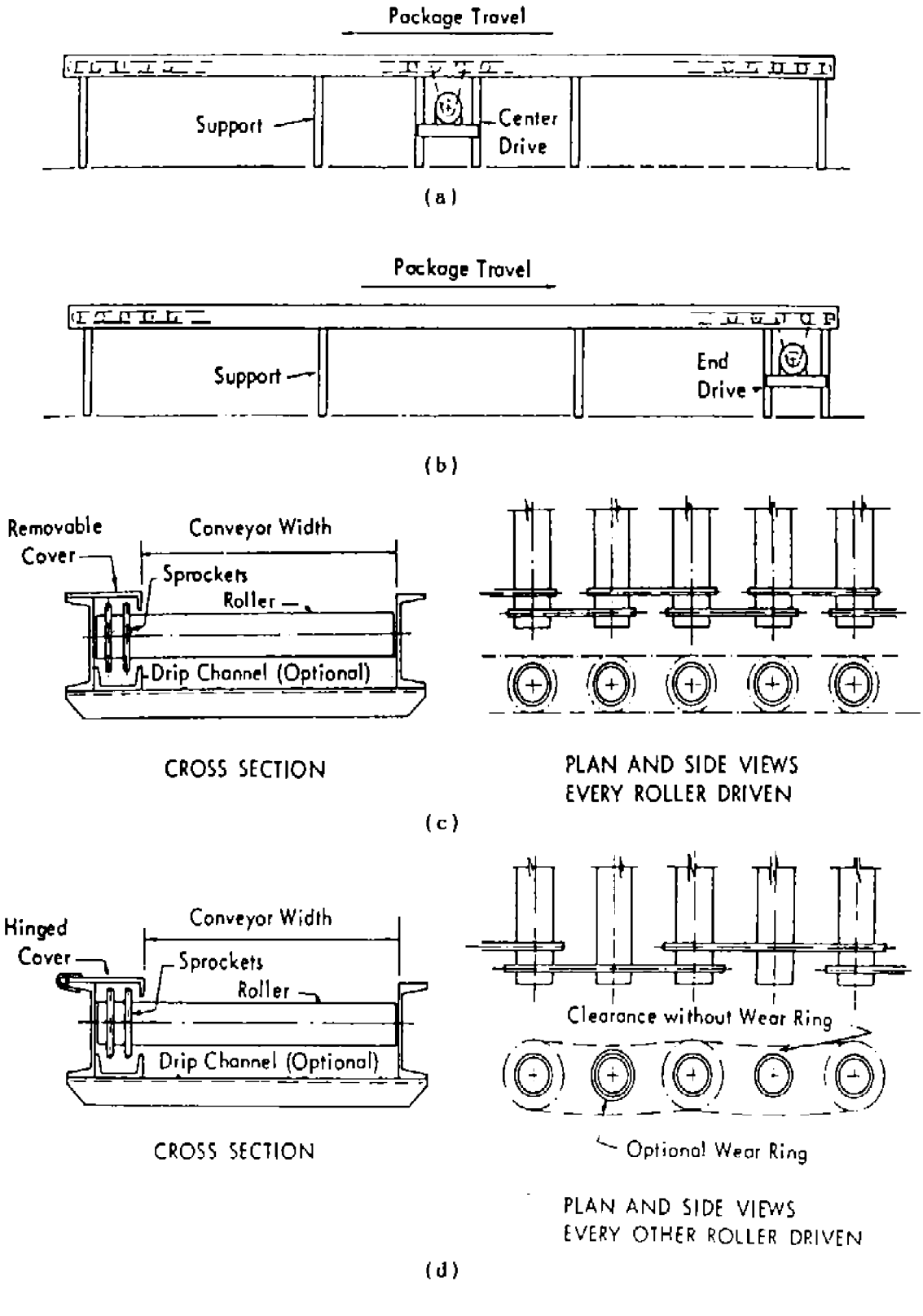
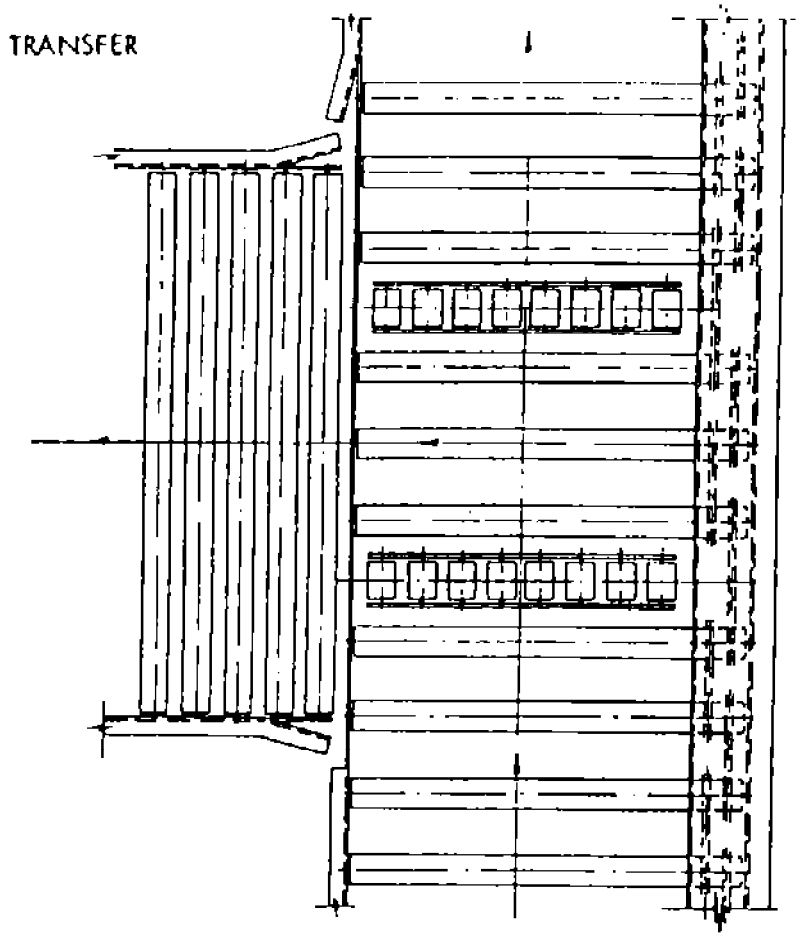


Fig. 6.3



DISAPPEARING GRAVITY ROLLER SECTION
PLAN VIEW

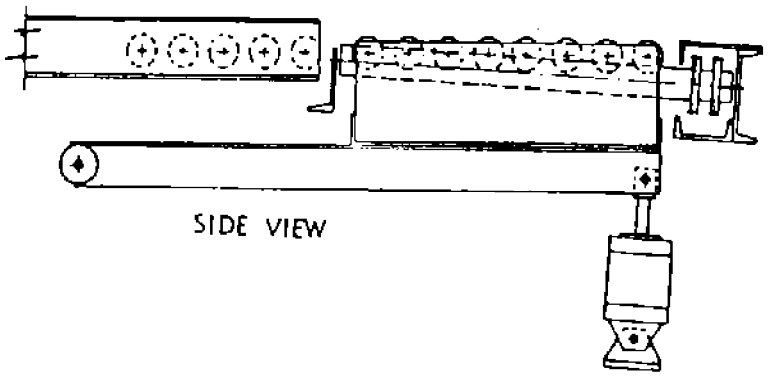
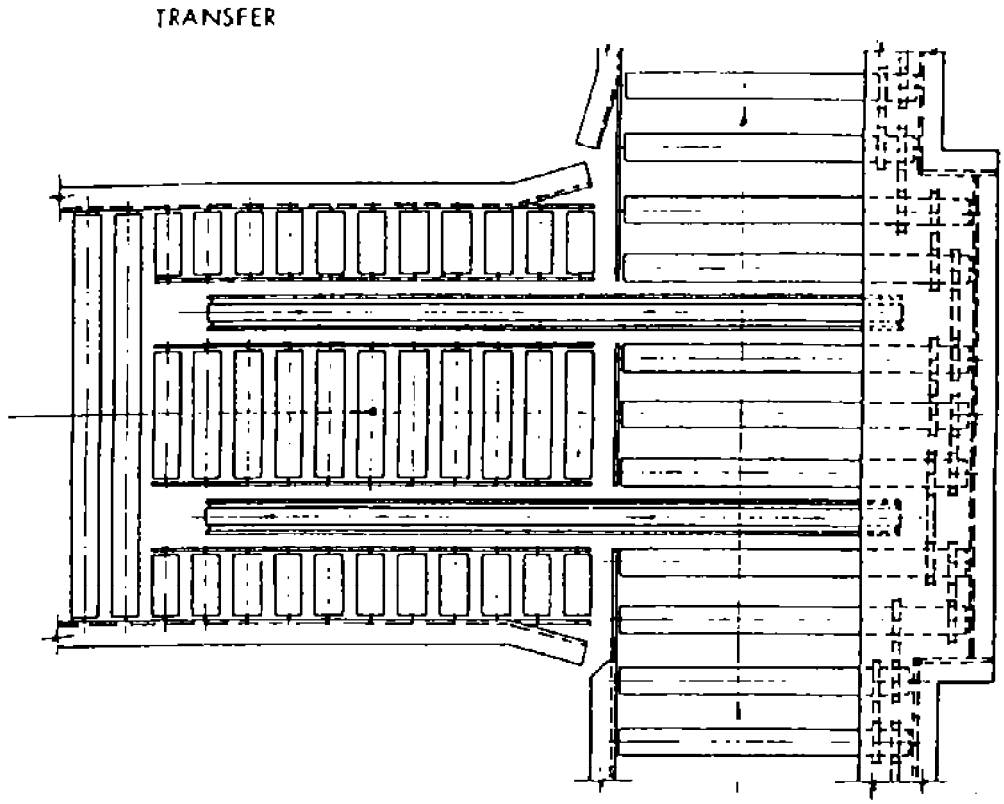
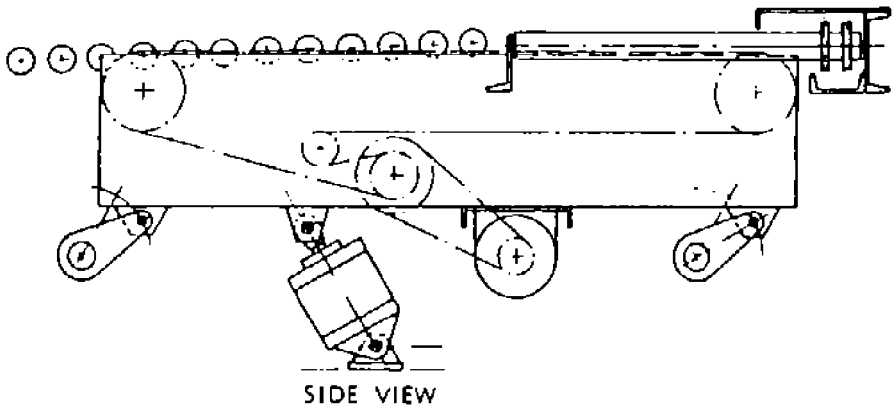


Fig. 6.4



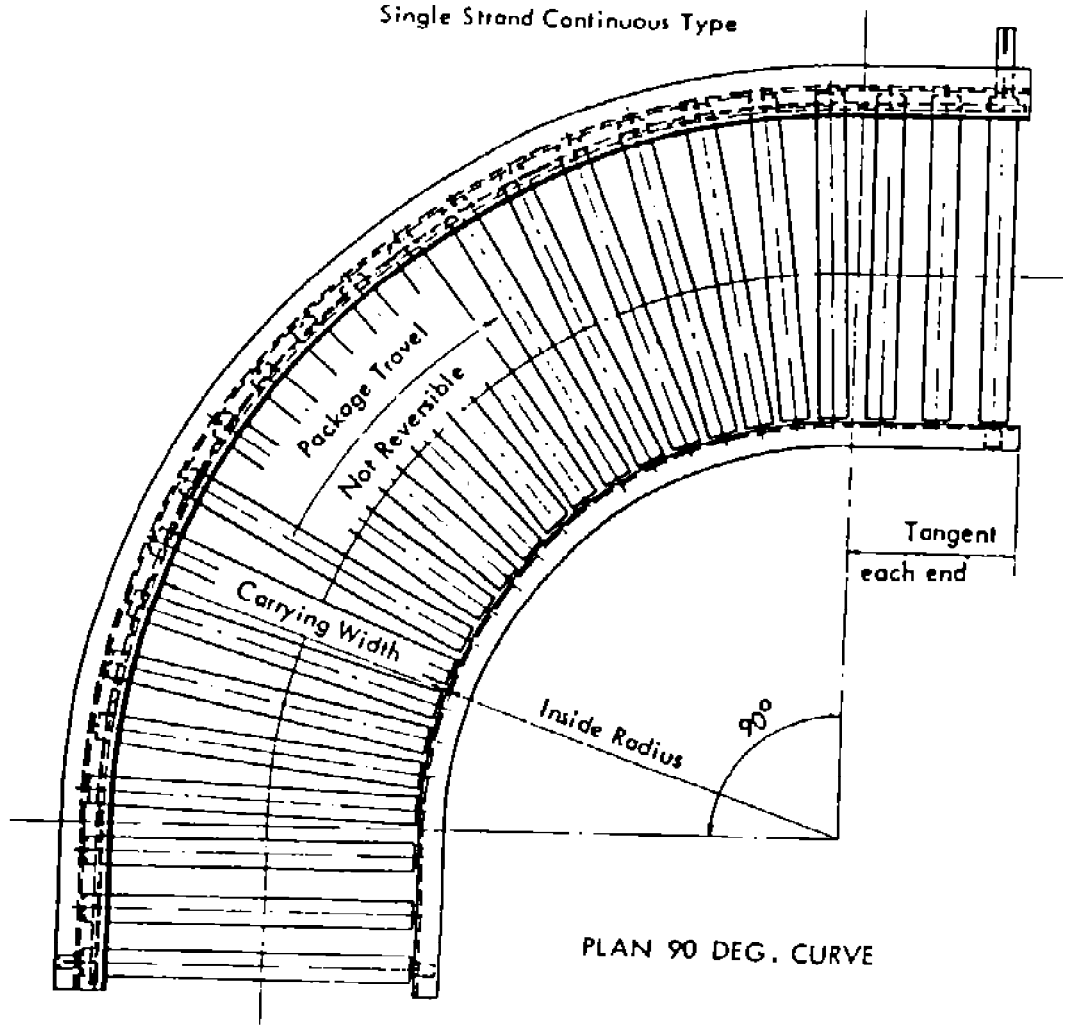
RIGHT ANGLE CROSS CHAIN
PLAN VIEW



SIDE VIEW

Fig. 6.5

CHAIN DRIVEN LIVE ROLLER CURVE



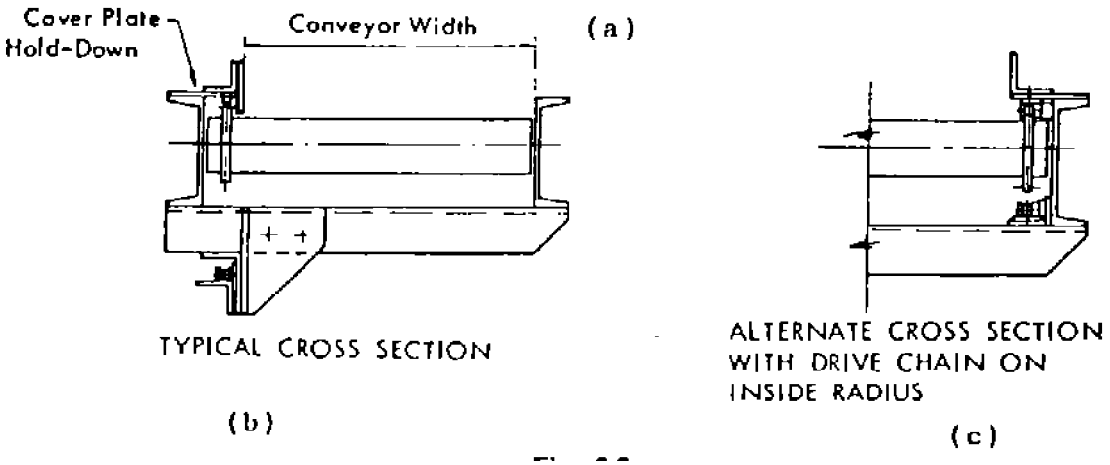


Fig. 6.6

CHAIN DRIVEN LIVE ROLLER CURVE
ROLLER TO ROLLER TYPE

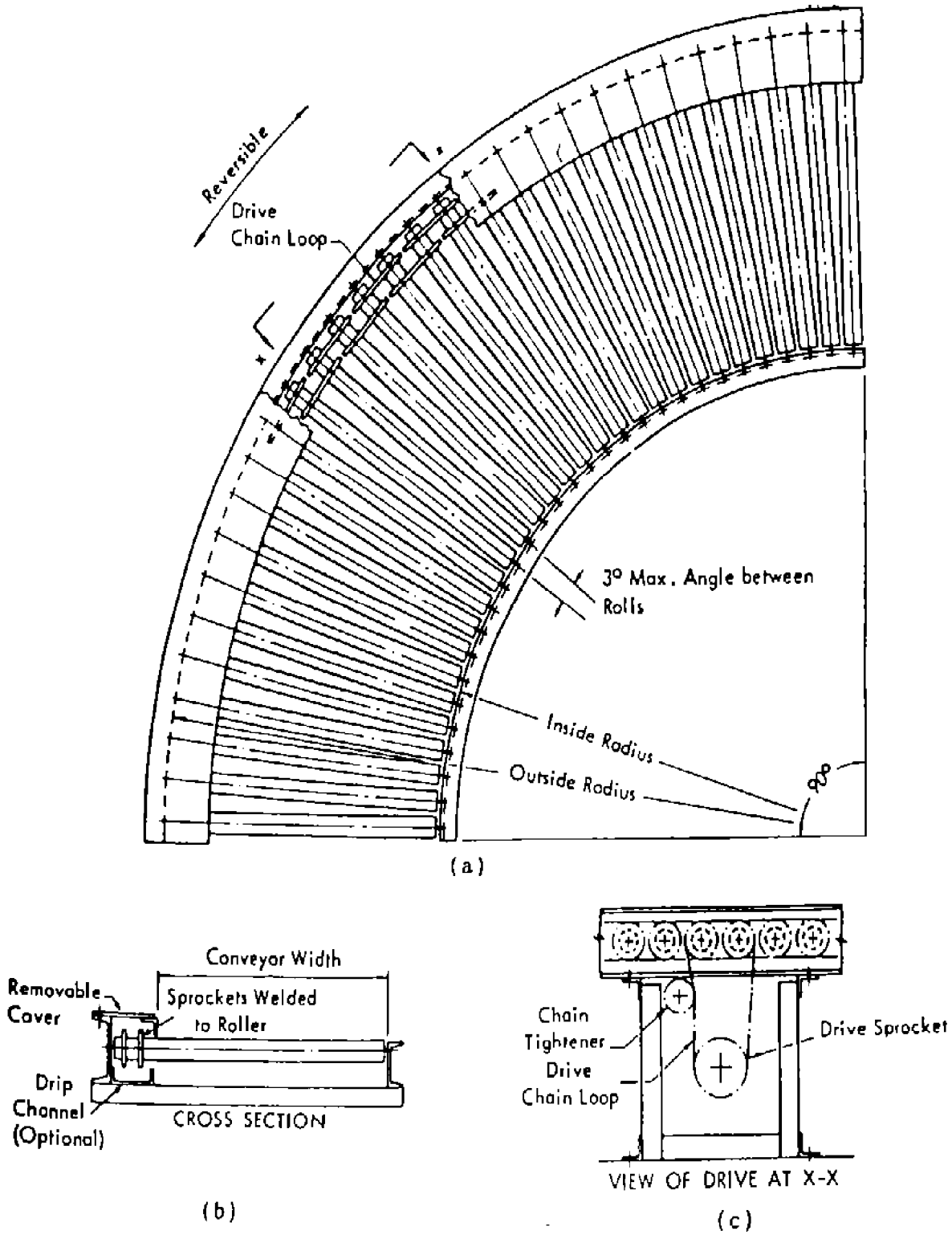


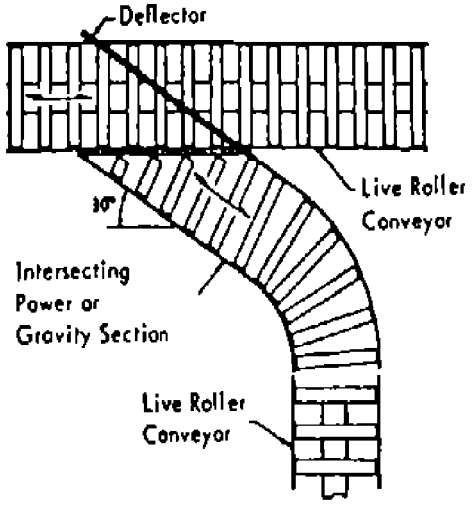
Fig. 6.7

Notes:

a) Chain driven live roller Curves can be reversible and are furnished with separate drive or driven from connecting conveyor.

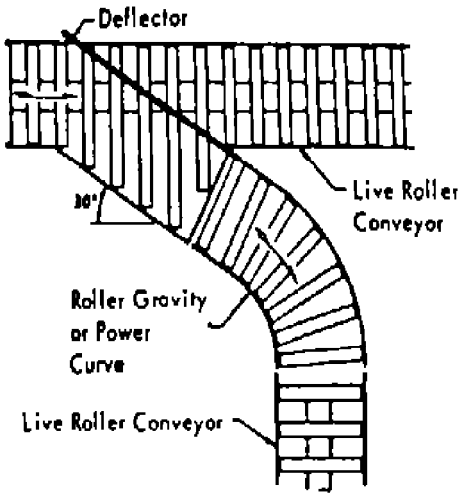
b) Recommended for heavier duty service.

BELT DRIVEN LIVE ROLLER TRANSFERS



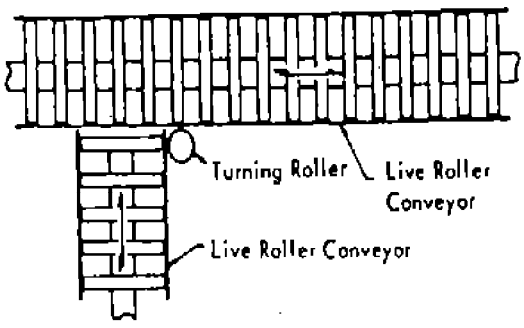
(a)

Intermediate Unloading Transfer with Intersecting Gravity Section. Used for discharging from main line to spur line conveyor. Suitable for individual or continuous line of packages. Also for unusually long or odd shapes not suitable for Fig. 6.8.c Transfer. When loading from spur line, both conveyors are reversed and deflector is omitted.



(b)

Similar to Fig. 6.8.a Transfer except with positive unloading section. Less gap at transfer point is particularly desirable for small packages. When loading from spur line, both conveyors are reversed and deflector is omitted.



(c)

Right angle Live Roller to Live Roller Transfer. Requires separation of packages on incoming conveyor. Unusually long or odd shaped packages generally require Fig. 6.8.a or 6.8.b Transfer.

Fig. 6.8

90° BELT DRIVEN LIVE ROLLER CURVE

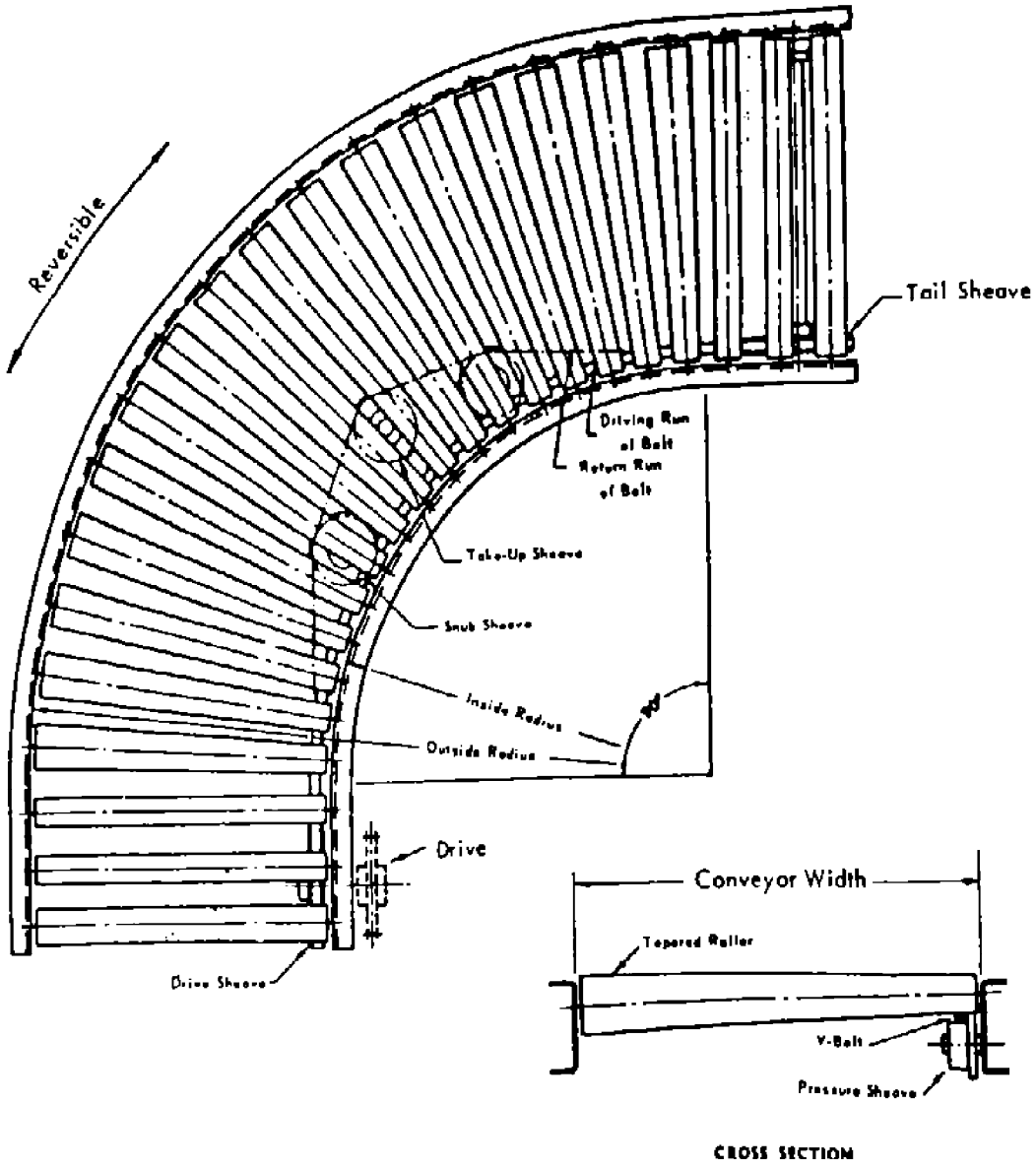
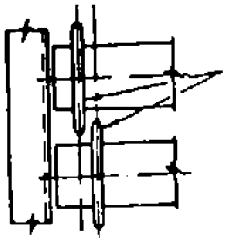


Fig. 6.9



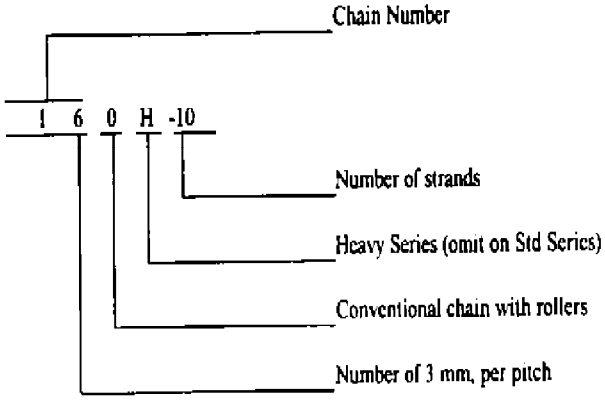
Staggered sprockets driven by single strand of double width chain can sometimes be used where very close centers are required

Fig. 6.10

7. ROLLER CHAIN

7.1 Chain Designation

Chain covered by this specification is identified by the designation shown in example below and in more detail in ANSI standard B29.1. The right hand digit in the chain number is zero for roller chains of the usual proportions; 1 for light weight chain*; and 5 for a rollerless bushing chain**. The numbers to the left of the right hand digit denote the number of 3 mm in the pitch. The letter H following the chain number denotes the heavy series. Absence of the letter H denotes the standard series. The hyphenated number 2 suffixed to the chain number denotes a double strand, 3 a triple strand, 4 a quadruple strand chain, etc. For example, a heavy series, ten strand, 50.80 mm pitch (Number 160) chain is designated as shown in the example below.



7.2 Heavy Series Chains

Heavy series chains are made in 19.05 mm and larger pitches and differ from the standard series in thicknesses of link plates. Their value is only in the acceptance of higher loads during operation at lower speeds.

7.3 Dimensions

The general dimensions for roller chains shown in Figs. 7.1 and 7.2 shall be as specified in ANSI Standard B 29.1.

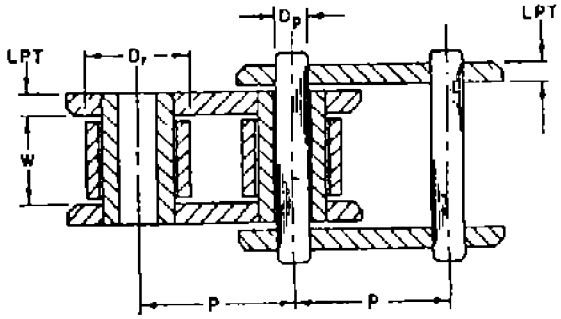
7.4 Tensile Strength

Both standard series and heavy series single strand chains shall have a minimum ultimate tensile or breaking strength in pounds equal to or greater than 12500 × (pitch in inches)^2. For multiple strand standard series and heavy series chains, the minimum ultimate tensile or breaking strength in pounds shall equal that of a single strand chain multiplied by the number of strands.

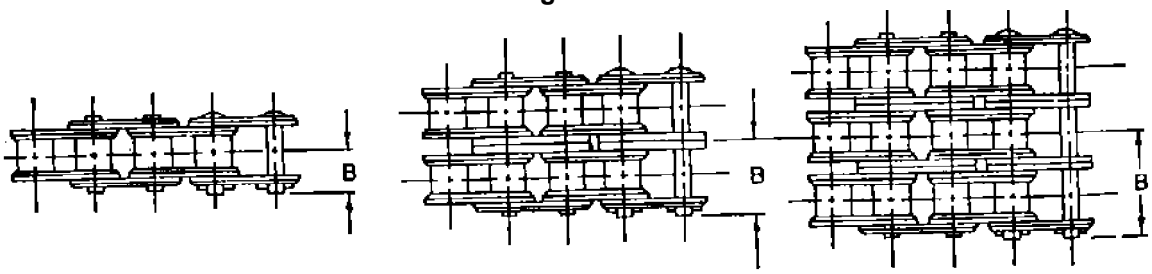
7.5 Chain Length Tolerance

New chain, under standard measuring load (see ANSI B 29.1), shall be subject to a tolerance of y 1.30, -0 mm/m of length.

*** Chain number 41, standard series, is the only chain furnished in the light weight design.**
**** Chain number 25 and 35, standard series, are the only chains furnished without rollers.**



CHAIN ASSEMBLY
Fig. 7.1



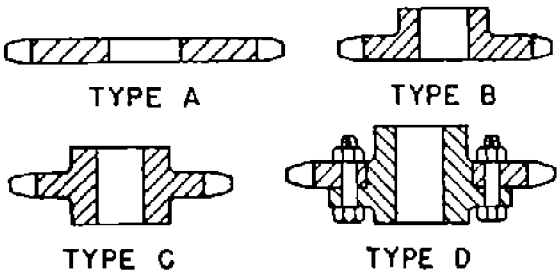
SINGLE AND MULTIPLE CHAIN ASSEMBLIES
Fig. 7.2

8. SPROCKETS FOR ROLLER CHAIN

8.1 Sprocket Types

Four types of sprockets covered by this specification are shown in Fig. 8.1 and are designated as:

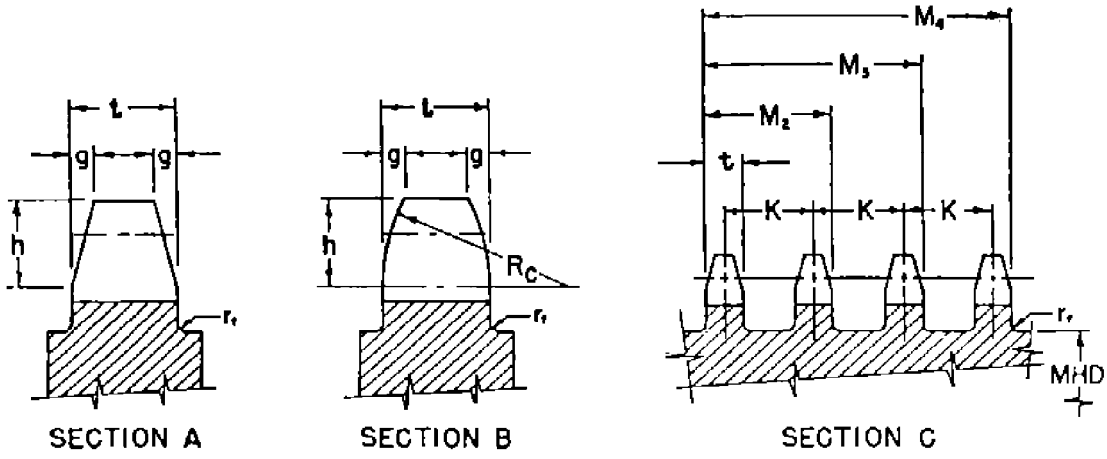
Type A Plain plate,
Type B Hub on one side only,
Type C Hub on both sides,
Type D Hub detachable.



SPROCKET TYPES
Fig. 8.1

8.2 Tooth Profile

Fig. 8.2, Sections A and B, shows the recommended sprocket tooth chamfer for roller chains. Fig. 8.2, Section C, shows sprocket tooth flange location for multiple strand roller chains. All sprocket flanges shall be chamfered to guide the chain onto the sprocket in case of misalignment due to sprocket misalignment or permissible flange weave. Flange chamfer may be either as in Section A or B or any intermediate profile. The fillet radius r_f max. equals 0.04 × pitch for maximum hub diameter. Other dimensions indicated in Fig. 8.2 shall be as specified in ANSI B 29.1 for precision sprockets.



SPROCKET TOOTH PROFILE
Fig. 8.2

8.3 Sprocket Application

Sprockets used on roller chain drives should be cut with standard tooth form cutters. A sprocket having a caliper diameter larger than the nominal dimension can cause early destruction of a chain drive. For this reason, ANSI B 29.1 manufacturing tolerances on this dimension are negative. Sprocket drawings should be dimensioned and tolerance indicated which will insure that the nominal caliper diameter will not be exceeded. Sprocket diameters shall be as specified in ANSI B 29.1.

8.4 Sprocket Tooth Forms

The standard tooth form design and seating curve data are shown in ANSI B 29.1.

8.5 Hub Dimensions

The important hub dimensions are the outside diameter, bore, and length. Except for the limitations on diameter, hub design is governed by maximum torque requirements:

1) The maximum hub diameter is limited by the need to clear the chain link plates. In some cases, the hubs of small diameter sprockets are grooved to provide this clearance.

2) The maximum bore is limited by the need for sufficient hub thickness to provide for a keyway and set screws.

3) Hub length must be sufficient to insure stability of the sprocket on the shaft.

8.6 Keyways

If keys are used to transmit torque between sprockets and shaft, they must be proportioned according to accepted design practice.

8.7 Cutter Sources

Cutters and hobs made in conformance with ANSI B 29.1 are available from standard cutter sources.

8.8 General Principles

Sprockets shall have tooth form, thickness, profile, and diameters conforming to this specification. For maximum service life, small sprockets operating at moderate to high speeds, or near the rated horsepower, should have hardened teeth. Normally, large sprockets should not exceed 120 teeth.

9. MATERIAL

Materials shall be selected complying ASTM Standard specifications or Equivalent.

10. RECOMMENDED INSTALLATION AND MAINTENANCE PRACTICES

10.1 Rigid Shaft Supports

Shafts must be rigidly supported in properly designed bearings. Shaft displacement will destroy initial alignment and shorten chain life.

10.2 Drive Alignment

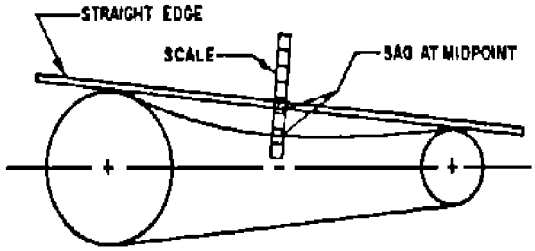
Drives should be carefully aligned before operation. Alignment procedure includes insuring that:

1) Shafts are level, i.e., lie in the same plane;
2) shafts are parallel;
3) sprockets are in line and not offset on the shafts.

Misalignment, particularly in multiple strand drives, results in uneven loading in the chain and can cause early failure. This is especially important on chain drives operating between two units of the rig (i.e., compound to drawworks or compound to pump). Care also must be taken to avoid deflection under load which will result in sprocket misalignment. A drive could be perfectly aligned when standing idle and still have destructive misalignment during operation due to structural deflection.

10.3 Chain Tension

Proper chain tension is essential. Too tight a chain will impose excessive bearing loads. Too loose a chain may cause noisy operation and chain pulsations which could result in abnormal chain and sprocket wear. For a check of chain tension, turn one sprocket to tighten the lower strand of chain; then measure the sag of upper strand as shown in Fig. 10.1. This sag measure at the midpoint, should be approximately two to three percent of the length of the tangent to the sprockets. An inclined drive should have less slack than a horizontal drive. For a vertical drive, provision for takeup of chain is desirable.



CHAIN SAG MEASUREMENT - HORIZONTAL DRIVE
Fig. 10.1

10.4 Freedom from Interference

Contact between the drive and adjacent objects must not occur. Ample clearances should be provided to allow for chain pulsations, possible end float of shafts, and chain elongation due to wear.

10.5 Center Distance

In general, a center distance of 30 to 50 chain pitches is most desirable. The distance between sprocket centers should provide at least 120 deg chain wrap on the smaller sprocket.

1) Drives may be installed with either adjustable or fixed center distances. Adjustable centers simplify the control of chain slack.

2) For drives on fixed centers, an idler or shoe may be used to provide slack adjustment. These devices may also be used to control backlash, or to assure 120 deg minimum chain wrap on the smaller sprocket.

3) The center distance to accommodate a whole number of pitches may be calculated from the following formula:

$$C = \frac{L - \frac{N+n}{2} + \sqrt{\left(L - \frac{N+n}{2}\right)^2 - 8\left(\frac{N-n}{4\pi}\right)^2}}{4}$$

Where:

C is center distance in pitches.
L is chain length in pitches.
N is No. of teeth on the large sprocket.
n is No. of teeth on the small sprocket.

4) The length of chain for a given drive may be calculated with the following formula:

$$L = 2C + \frac{N+n}{2} + \frac{(N-n)^2}{4\pi^2 C}$$

Note:

Above equations are approximations when center distance is adjustable or an idler is used. For fixed center drives use chain makers' recommendations.

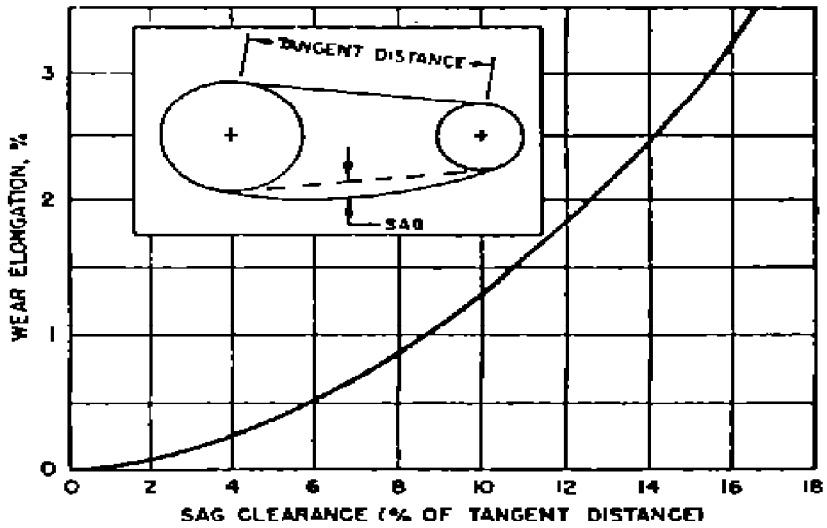
5) In designing a chain drive, theoretical center distances should normally be taken as nominal with the manufacturer's tolerance on the minus side. Center distance tables which give nominal center distance data are available from American roller chain manufacturers. Individual experience may indicate it to be desirable in certain cases to design to the plus side of theoretical, but this practice should be followed with caution. When a plus tolerance is permitted, there is risk of new chain being too tight around the sprockets. This can result in chain damage either in installation or during the break-in period.

10.6 Chain Casings

Chain casings are used to facilitate lubrication and to protect drives from damage by harmful atmospheric dusts. These casings are usually made of sheet metal, stiffened and supported, with access doors for inspection and maintenance of the drive:

1) Chain-guard or case clearance sometimes restricts the useful wear life of a chain. This happens as normal wear-induced slack collects at the slack or unloaded strand. When clearance is limited, wear-induced slack eventually becomes large enough for the chain to strike the case, damaging both case and chain.

2) Case clearance for allowable wear may be determined by using the information shown in Fig. 10.2. Conversely, a given sag measurement can be used to estimate the amount of wear on horizontal drives.



CASE CLEARANCE WEAR LIMIT
Fig. 10.2

10.7 Chain Protection

A new chain should be left in its box until installation. Chains are prelubricated at the factory, but this prelubrication will not stand up under outdoor weather, particularly in salt water atmosphere. In addition, chains are apt to become contaminated with grit and foreign material which will not only harm the chain, but will tend to clog strainers, filters, and oil lines. A roller chain should be thought of as a series of bearings that will perform best if handled like any other precision-made equipment.

10.8 Lubrication

It has been shown that a separating wedge of fluid lubricant is formed in operating chain joints much like that formed in journal bearings. Therefore, fluid lubricant must be applied to insure an oil supply to the joints and minimize metal to

metal contact. Lubrication, if supplied in sufficient volume, also provides effective cooling and impact damping at the higher speeds. For this reason, it is important that the lubrication recommendations be followed.

1) Chain drives should be protected against dirt and moisture and the oil supply kept free of contamination. Periodic oil change is desirable. A good grade of non-detergent petroleum base oil is recommended. Heavy oils and greases are generally too stiff to enter and fill the chain joints. Table 10.1 indicates the proper lubricant viscosity for various surrounding temperatures. These figures serve as a guide to provide a lubricant which will enter the pin-bush bearings at normal drive operating temperature.

2) If the same lubricant is used for related equipment such as bearings and hydraulic systems, then additional lubricant specifications should be considered. Examples: anti-foaming and extreme pressure additives, minimum viscosities and oil cleanliness.

TABLE 10.1 - RECOMMENDED LUBRICANT FOR VARIOUS SURROUNDING TEMPERATURES

1	2
SAE GRADE	*** SURROUNDING TEMPERATURE RANGE °C**
5 W	-45.6 to +10.0
10 W	-28.9 to +26.7
20 W	-12.2 to +43.3
30 W	-6.7 to +54.4
40 W	-1.1 to +60.0
50 W	+4.4 to +65.6

*** When the temperature range permits a choice of lubricant, the heavier grade should be used.**

10.9 Methods of Lubrication

Listed below are four basic types of lubrication for chain drives. The recommended type is influenced by chain speed and the amount of power transmitted. These are minimum lubrication requirements and the use of a better type (for example, Type IV instead of Type III) may be beneficial. Chain life can vary appreciably, depending upon the way the drive is lubricated-the better the lubrication, the longer the chain life:

Type I: Manual Lubrication

Oil is applied periodically with a brush or spout can, preferably once every 8 hrs. of operation. Volume and frequency should be sufficient to prevent discoloration of lubricant in the chain joints.

Type II: Drip Lubrication

Oil drops are directed between the link plate edges from a drip lubricator. Volume and frequency should be sufficient to prevent discoloration of lubricant in the chain joints. Precaution must be taken against misdirection of the drops by windage.

Type III: Bath or Disc Lubrication

With bath lubrication the lower strand of chain runs through a sump of oil in the drive housing. The oil level should reach the pitch line of the chain at its lowest point, while operating. With disc lubrication, the chain operates above the oil level. The disc, dipping about 12.7 mm into the oil, picks up oil from the sump and deposits it onto the chain, usually by means of a trough. The diameter of the disc should be such as to produce rim speeds between 185 m/min. minimum and 1440 m/min. maximum. Continued operation at extreme speeds and with too much oil can cause overheating and foaming of the oil.

Type IV: Oil Stream Lubrication

The lubricant is usually supplied by a circulating pump capable of supplying each chain drive with a continuous stream of oil. The oil should be applied inside the chain loop evenly across the chain width, and directed at the lower strand. Up to 0.06 dm^3/s per chain strand may be required to give proper drive cooling.

10.10 Recommended Method

Table 10.2 shows the type of lubrication recommended for various combinations of pitch and speed. Consult product manufacturers or chain manufacturers, when it appears desirable to use a type of lubrication other than that recommended. Basic factors to control are chain and case temperatures during drive operation. Depending upon severity of service, continuity of use, etc., special attention to lubrication may be needed. Chain temperatures above 93.3°C should be avoided. Increase in oil volume, greater flow rate (up to one gallon per minute per chain strand) and external cooling of the oil are ways of improving effectiveness of drive lubrication and cooling. Experience with a specific drive may show that for low load or short life requirements, extension upwards may be made of the rpm ratings for the various lubrication types.

TABLE 10.2 - RECOMMENDED LUBRICATION TYPE FOR VARIOUS COMBINATIONS OF PITCH AND SPEED

1	2	3	4	5
CHAIN PITCH, mm	LUBRICATION TYPE			
	I	II	III	IV
	CHAIN SPEED, m/min			
	max.	max.	max.	over
6.35	150	760	1065	1065
9.53	115	520	855	855
12.70	90	395	700	700
15.88	75	305	610	610
19.05	65	260	550	550
25.40	50	200	455	455
31.75	45	160	395	395
38.10	40	130	365	365
44.45	35	115	335	335
50.80	30	100	305	305
57.15	29	90	290	290
63.50	26	80	275	275
76.20	23	65	245	245

10.11 Connecting Links

When a connecting link is being assembled into the chain, it is necessary that the outside link plate be driven down far enough on the chain pins to permit insertion of the fasteners. After the fasteners have been inserted, it is important that the ends of the chain pins be tapped back so that the fasteners come up snugly against the outside of the connecting link plate. By doing this, three important things are accomplished:

1) The designed clearance between link plates across the chain width are maintained. A connecting link plate driven down too far on the pins "squeezes" the chain joint so that no oil can get between the link plates.

2) This "squeezing" prevents joints from flexing freely as they go around the sprocket. Proper assembly of the connector will assure smooth chain action with a minimum whipping of the chain.

3) With the fasteners snugly against the connecting link plate, there will be less tendency for them to work loose and fall out.

10.12 Offset Links

The use of offset links should be avoided wherever possible, for best performance; however, if an offset link is necessary, it should be assembled permanently into the chain with press-fit pins. The press fit pin specification is available only in offset assemblies of two or more pitches, depending on the manufacturer's design.

10.13 Periodic Inspection

Periodic inspection to discover incipient faults pays big dividends in extended chain life and freedom from shutdowns.

1) Inspection Schedule

In general, inspections can coincide with those for other precision parts of the associated equipment. Experience will indicate any need for changes in the inspection schedule. The major requirement is to establish a practical schedule, and to follow it faithfully. As with all new equipment, some readjustments may be required during the initial "run-in" period. Therefore, the initial schedule should provide for frequent inspections. After the drive has been run-in, the time between inspections may be extended, but such changes should be made gradually as experience dictates.

2) Inspection Items

a) Wear on Link Plates and Sides of Sprocket Teeth

Check for wear on sides of the sprocket teeth and on the link plates. Such wear indicates misalignment.

b) Shaft and Sprocket Alignment

Measure shaft and sprocket alignment. This will permit correction of misalignment before wear on chains and sprockets becomes damaging.

c) Sprockets

Check for wear on the working faces of the sprocket teeth. As the drive runs-in, these faces should develop a bright, polished appearance. Visible changes in tooth form are signs of trouble, probably caused by improper lubrication.

d) Chain Elongation

As chain wears it rides higher on the sprocket teeth. When elongation becomes excessive, the chain jumps the sprocket teeth, causing damage to both chain and sprockets. Gradual increase in chain length is the result of normal wear. A sudden increase in slack indicates one or more of the following:

- lubrication failure;
- excessive overloading or shocks;
- displacement of bearings;
- displacement or failure of take-ups.

An indication of the magnitude of chain elongation may be obtained by comparing the amount of sag with that measured at installation.

e) Cleanliness

Check the chain and the sprocket teeth for accumulations of dirt or foreign materials and for evidence of corrosion. Such accumulation will reduce chain drive life.

f) Lubrication

For all types of lubrication, check to see if the grade of lubricant is as recommended in Table 10.1. Also examine lubricant for freedom from dirt, water, and other contamination.

For manual lubrication, make sure that the lubrication schedule is being followed, and that the oil is being properly applied.

For drip lubrication, inspect the filling of the oiler cups and the rate of feed; check that the feed pipes are not clogged.

For bath or disc systems, inspect the oil level and check that there is no sludge. Drain, flush, and refill the system periodically.

For force feed systems, inspect the oil level in the reservoir, check the pump drive and the delivery pressure; check that there is no clogging of the piping filters or nozzles. Drain, flush, and refill the reservoir periodically.

If roller chains have not been lubricated properly, the joints will have a brownish (rusty) color and the pins of the connecting link of the chain, when removed, will be discolored (light or dark brown). Also, the pins will be roughened, grooved, or galled.

Properly lubricated chains will not show the brownish color at the joints and the connecting link pins will be brightly polished.

10.14 Chain Repair and Replacement

If a chain has had three or more parts which have failed, it should be replaced. By the time three failures have occurred, it is quite certain that many more failures are on the way, and the down time on the rig will represent more of an expense than the price of another chain. Naturally there will be times when excessive repairs will have to be made to keep operating, but plans should be made to replace the chain at the earliest practical time.

The entire chain should be replaced, not just a part of it because:

1) At that point the entire chain probably has numerous incipient failures even though it has not failed over its entire length;

2) a new piece of chain (or even a used piece) when spliced into another chain will cause whipping and load pulsation.

This can produce very rapid failure in the chain, even in the brand-new section. It will also accelerate wear in both chains and sprockets. The installation of a new chain on worn sprockets can cause rapid damage to the chain and a drastic reduction in chain life.

11. SAFETY

Chain and belt driven live roller conveyors shall be designed with safety provisions for the protection of operating personnel in accordance with ASME/ANSI B20.1 latest edition concerning the following:

a) Nip points occur between chain and sprockets on chain driven live roller conveyors.
b) Nip points occur on transfers and deflectors used with live roller conveyors.
c) Shear points occur at automatic take-ups; they shall be guarded.

11.1 Guarding

On chain driven live rollers, in addition to covering the top of the sprockets, the guard shall extend downward to obstruct entrance from the side and from below, or the underside shall be covered, unless guarded by location or position.

11.2 Safety Devices

All safety devices, including wiring of electrical safety devices, shall be arranged to operate in a "fail safe" manner; that is, if power failure or failure of the device itself would occur, a hazardous condition must not result.

11.3 Emergency Stops and Restarts

Conveyor controls shall be so arranged that, in case of emergency stop, manual reset or start at the location where the emergency stop was initiated shall be required for the conveyor(s) and associated equipment to resume operation.

11.4 Other Requirements

11.4.1 Access to inspection holes shall be easy.

11.4.2 All the frequently used lubrication points shall be accessible without it being necessary to remove the guards.

11.4.3 It is recommended that equipment be so designed that cleaning is facilitated.

11.4.4 Sharp edges and corners are to be avoided.

11.4.5 The projecting parts of moving equipment must be as small as possible.

11.4.6 The loading and unloading openings of the enclosed units (in casing or in housing) must be made in such a way that they prevent access to the moving components; otherwise suitable protection shall be provided.

12. NAMEPLATE

12.1 A name plate made of stainless steel shall be attached on a visible portion of the conveyor, indicating revolution speed, rated horsepower, name of manufacturer, serial number, and year of manufacture.

12.2 A tag plate indicating the direction of chain sprocket and/or pulley rotation by an arrow shall be provided near the driver.

13. CONVEYOR INSPECTION AND TESTING

The conveyors completed in the fabrication shop or field assembled shall be subjected to the following inspections and tests after being assembled.

a) Visual and dimensional check of assemblies
b) Noise level check under no load conditions
c) Running test and performance test of assemblies
d) Safety device check under no load conditions

14. PREPARATION FOR SHIPMENT

14.1 Equipment shall be suitably prepared for the type of shipment specified. The preparation shall be mutually agreed upon and unless otherwise specified, shall make the equipment suitable for 12 months of outdoor storage from the time of shipment.

14.2 The Vendor shall provide the Purchaser with the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the job site and before start-up.

14.3 One copy of the manufacturer's standard installation instructions shall be packed and shipped with the equipment.

14.4 Each part of the conveyor shall be affixed with a metal tag, indicating it's name and part number to facilitate assembling.

14.5 Unless otherwise specified, separate shipment of equipment is not allowed.

15. GUARANTEE AND WARRANTY

Unless exception is recorded by the Vendor in his proposal, it shall be understood that the Vendor agrees to the following guarantees and warranties.

During a period of 12 months after the date of commissioning, the Vendor shall, with all possible speed and without cost to the Purchaser, replace or repair the goods or any part thereof found to be defective due to faulty material workmanship or to any act or omission of the Vendor. In the particular the Vendor shall reimburse any transportation and other charges incurred by the Purchaser in effecting such replacement or repair at the point of use.

APPENDICES

APPENDIX A
INFORMATION TO BE SUPPLIED WITH INQUIRY OR ORDER

The following particulars will enable the manufacturer to select the most suitable equipment from his production range to suit the proposed application:

1) Maximum and minimum sizes of loads* in millimeters
2) Maximum and Minimum weights of load in Kilograms
3) Particulars of running surface if not flat and rigid
4) Any special operational conditions including area classification
5) Whether fixed or adjustable stands are required
6) Maximum accumulating load per 2.5 m length, or 3 m length, in kilograms
7) Conditions of loading i.e. single load travel or batching
8) Details of any impact loading, including its location, i.e. locally or continuously along the track
9) Electric supply characteristics
10) If possible, a sketch of the proposed layout, with such details as available clearance heights

*** First dimension given to be that of the leading edge normal to the direction of travel.**

APPENDIX B
INFORMATION TO BE SUPPLIED BY THE MANUFACTURER

1) Maximum and minimum sizes of loads* in millimeters
2) Maximum and minimum weights of loads in kilograms
3) Maximum accumulating load capability per 2.5 m length, or 3.0 m length, in kilograms
4) Rollers

- **a)** Length in millimeters
- **b)** Diameter in millimeters
- **c)** Pitch in millimeters
- **d)** Thickness of tube in millimeters
- **e)** Spindle size in millimeters
- **f)** Type of bearing (including sealing arrangement if applicable)
- **g)** Method of retaining spindle in frame
- **h)** Full roller chain and/or belt characteristics

5) Track

- **a)** Type and arrangement of frame members
- **b)** Length in meters
- **c)** Overall width in millimeters
- **d)** Height from bottom of track to top of roller in millimeters

6) Connections: Type of coupling between track sections
7) Stands

- **a)** Type
- **b)** Fixed (with fixing details) or free standing
- **c)** Pitch in meters

8) Guard rails

- **a)** Type
- **b)** Overall height from top of rollers in millimeters

9) Sprocket types and tooth profile
10) Electric motor driver characteristics

*** First dimension given to be that of the leading edge normal to the direction of travel. (to be continued)**

APPENDIX C
VENDOR DATA REQUIREMENTS AFTER RECEIPT OF ORDER

Vendor shall furnish the following data in the number of copies and in the number of calendar days agreed upon by the Purchaser after receipt of order. Certified data shall be submitted within thirty (30) calendar days after return of approval for data.

1) Equipment general arrangement DWG
2) Outline dimensions
3) Cross section
4) Foundation layout, anchor bolt details, etc.
5) Wiring diagrams
6) Instrument panel layout & dimensions
7) Erection drawings, & diagrams
8) Instrument installation DWGs
9) Bill of materials
10) Complete part list
11) Recommended spare parts for 2 years operation
12) Recommended spare parts for commissioning
13) Instructions-installation, operation, and maintenance manual as requested

PART THREE

SCREW CONVEYORS

CONTENTS :

PAGE No.

APPENDICES:

1. SCOPE

This Standard specification covers the general requirements for the design, fabrication and inspection of screw conveyors and screw feeders for bulk materials.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor:

IPS (IRANIAN PETROLEUM STANDARDS)

E-GN-100	"Units"

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

B 20.1	"Safety Standard for Conveyors and Related Equipments"

ANSI/CEMA (AMERICAN NATIONAL STANDARD INSTITUTE / CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION)

ANSI/CEMA 102	"Conveyor Terms and Definitions"
ANSI/CEMA 550	"Classification and Definitions of Bulk Materials"
ANSI/CEMA 350	"Screw Conveyors"
ANSI/CEMA 300	"Screw Conveyor Dimensional Standard"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIAL)

3. CONFLICTING REQUIREMENTS

In the case of conflict between documents relating to the inquiry or order, the following priority of documents shall apply:

- **First Priority:** Purchase order and variations thereto.
- **Second Priority:** Data sheets and drawings.
- **Third Priority:** This Standard specification.

All conflicting requirements shall be referred to the Purchaser in writing. The Purchaser will issue confirmation document if needed for clarification.

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

5. DESIGN

5.1 General

5.1.1 Conveyors terminology in design shall be in accordance with ANSI/CEMA Standard No. 102.

5.1.2 The design classification and definitions of bulk materials to be conveyed shall be in accordance with ANSI/CEMA Standard No. 550.

5.1.3 In the handling of some toxic materials, the enclosing trough shall be made tight enough to contain toxic dust or vapors.

5.2 Enclosures

5.2.1 Screw conveyor enclosures shall be ANSI/CEMA No. 350 Class III-E for indoor or sheltered service, and Class IV-E for outdoor applications. Enclosures shall be designed to allow access over the entire length of the conveyor.

5.2.2 Outboard bearing ends with pillow block bearings are required. Flush type bearings ends are not acceptable.

5.2.3 Trough end seals shall be the packed gland type.

5.3 Sizing

5.3.1 Screw conveyors shall be sized based on a trough loading of no greater than 30% of trough volume with the specified lowest material bulk density exhibited during transport by the equipment.

5.3.2 The use of intermediate bearings shall be reviewed by purchaser.

5.3.3 The use of sloped conveyors shall be reviewed by purchaser.

5.3.4 Screw specified feeders shall be sized based on 95% of trough volume with the specified lowest material bulk density exhibited during transport by the equipment.

5.3.5 Screws for feeders shall be tapered diameter, or variable pitch or constant diameter, to draw material uniformly across the length of the feed opening.

5.4 Components

5.4.1 The dimensions of components for screw conveyors and feeders shall be determined in accordance with ANSI/CEMA Standard No. 300 series.

5.4.2 Bearing materials for intermediate hangers shall be selected with consideration to abrasiveness and corrosiveness, together with the characteristics of the materials to be conveyed. Bearings will normally be selected from one of the following four (4) types in accordance with the design conditions:

a) Babbitted or bronze bearings
b) Self lubricated bearings
c) Ball bearings
d) Hard iron bearings

5.5 Platforms and Walkways

5.5.1 Platforms shall be provided in locations convenient for the operation and maintenance of large inclined or vertical screw conveyors and screw feeders.

5.5.2 Grating shall normally be used for platform flooring.

5.5.3 Walkways shall be provided along one side only for individual screw conveyors, and shall have handrailing and toeplates along the outside edge.

6. MATERIAL

Conveyor materials shall be selected according to ASTM Standard specifications or equivalent.

7. NAMEPLATE

7.1 A nameplate made of stainless steel shall be attached on a visible portion of the equipment, indicating revolution speed, rated horsepower, etc.

7.2 A tag plate indicating the direction of screw rotation by arrow shall be provided near the driver.

8. INSPECTION AND TESTING

The screw conveyors and feeders completed in the fabrication shop or field assembled shall be subjected to the following tests and inspections after being assembled.

1) Visual and dimensional check of assemblies
2) Noise level check under no load conditions
3) Running test and performance test of assemblies
4) Safety device check under no load conditions

9. SAFETY

9.1 General

Screw conveyors and feeders shall be designed with safety provisions for the protection of operating personnel, in accordance with ANSI B 20.1.

In addition to the safety rules set out in ANSI B 20.1, each part of the safety code in this Standard is divided into three clauses dealing with the safety rules applying to the following stages:

a) Construction (design and manufacture)
b) Installation (layout, erection and entry into service)
c) Utilization (operation and maintenance)

9.2 In the Construction Stage (Design and Manufacture)

9.2.1 The constructional features and quality of screw conveyors and feeders shall be determined on the basis of their intended service life and condition of usage.

9.2.2 Screw conveyors and feeders shall be capable of operation within the specified noise limits or statutory requirements.

9.2.3 Upper openings of troughed appliances shall be guarded, apart from feed and discharge areas.

9.2.4 The opening of covers, inspection doors and the covers of such protective devices as are liable to expose the screw elements while the machinery is in operation shall be prevented by means of locking.

Should the user notify the constructor in writing that he intends to allow the opening of inspection doors or such protective devices as are liable to expose the screw elements while the machinery is in operation, fixed guards must be provided to prevent any contact with the screw elements.

For example, a screen with openings not exceeding 40 mm × 40 mm should be fitted at a minimum distance of 100 mm from the screw edge.

9.2.5 Inlet and outlet apertures shall be so designed as to prevent free access to moving parts. Otherwise, provision shall be made for suitable protective guards.

9.2.6 Lubrication of intermediate screw bearings shall be possible without removing the trough or cover of conveyors.

9.2.7 For cleaning purposes, removable protective panels shall be fitted on the base of conveyors.

9.2.8 Should a screw conveyor be required to convey dangerous or harmful products, the user shall notify the constructor and specify what special safety features are needed in the design of the equipment.

For example where the possibility of fire or explosion exists, the pitch of the intermediate bearings shall ensure that the screw cannot touch the inside of the casing.

9.3 During the Installation Stage (Layout, Erection and Entry into Service)

9.3.1 Screw conveyors shall be fed regularly by appropriately designed devices.

9.3.2 If the vertical screw conveyor is equipped with a hand-operated variable-speed drive, and if the controls are more than 1.5 m above operating level, a fixed means of access shall be provided.

9.4 During the Utilization Stage (Operation and Maintenance)

9.4.1 In compliance with the existing regulations the personnel shall not be allowed to clean the inside of the trough or carry out any other inspection therein without first having stopped the screw and rendered the starting devices inoperative.

9.4.2 However, should the screw conveyor fail to start again normally due to blockage, it shall be possible to reverse it.

9.4.3 Free access to the unprotected rotating part of a screw shall be forbidden to all persons other than the supervisory and maintenance personnel. No action shall be taken by the latter without having first stopped the screw and taken all precautions to prevent it being prematurely started up.

10. PREPARATION FOR SHIPMENT

10.1 Equipment shall be suitably prepared for the type of shipment specified. The preparation shall be mutually agreed upon and unless otherwise specified, shall make the equipment suitable for 12 months of outdoor storage from the time of shipment.

10.2 The Vendor shall provide the Purchaser with the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the job site and before start-up.

10.3 Each part of the conveyor shall be affixed with a metal tag, indicating it's name and part number to facilitate assembling.

10.4 One copy of the manufacturer's standard installation instructions shall be packed and shipped with the equipment.

10.5 Unless otherwise specified, separate shipment of equipment is not allowed.

11. GUARANTEE AND WARRANTY

Unless exception is recorded by the Vendor in his proposal, it shall be understood that the Vendor agrees to the following guarantee and warranties:

During a period of 12 months after the date of commissioning, the Vendor shall, with all possible speed and without cost to the Purchaser, replace or repair the goods or any part thereof found to be defective due to faulty material, workmanship or to any act or omission of the Vendor. In the particular the Vendor shall reimburse any transportation and other charges incurred by the Purchaser in effecting such replacement or repair at the point of use.

APPENDICES

APPENDIX A
INFORMATION TO BE SUPPLIED WITH INQUIRY OR ORDER

The following particulars will enable the manufacturer to select the most suitable equipment from his production range to suit the proposed application:

1) Electric supply characteristics.

2) Bulk density of the material to be conveyed.

3) Any special operational conditions (such as in high temperatures, or in dusty, corrosive or abrasive atmospheres, or in humid or wet conditions, or on exposed sites).

4) If possible, a sketch of the proposed layout, with such details as available clearance heights.

APPENDIX B
VENDOR DATA REQUIREMENTS AFTER RECEIPT OF ORDER

Vendor shall furnish the following data in the number or copies and in the number of calendar days agreed upon by the Purchaser after receipt of order. Certified data shall be submitted within thirty (30) calendar days after return of approval for data.

1) Equipment general arrangement DWG
2) Outline dimensions
3) Cross section
4) Foundation layout, anchor bolt details, etc.
5) Wiring diagrams
6) Instrument panel layout & dimensions
7) Erection drawings, & diagrams
8) Instrument installation DWGs
9) Bill of materials
10) Complete part list
11) Recommended spare parts for 2 years operation
12) Recommended spare parts for commissioning
13) Completed specification sheets giving manufacturer, size, type of model of specific equipment.
14) Instructions, installation, operation, and maintenance manual as requested.

PART FOUR

BELT CONVEYORS

CONTENTS :

PAGE No.

APPENDICES:

1. SCOPE

This Standard specification covers the general requirements for the design, fabrication and inspection of belt conveyors for bulk materials, for use in refinery services, chemical, gas and petrochemical plants and where applicable in production and new ventures.

Compliance by the conveyor manufacturer with the provisions of this Standard does not relieve him of the responsibility of furnishing conveyor and accessories of proper design, mechanically suited to meet guarantees at the specified service conditions.

No deviations or exceptions from this Standard shall be permitted without the written prior approval of the Purchaser.

Intended deviations shall be separately listed by the Vendor and supported by reasons thereof for Purchaser consideration.

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor:

AISC (AMERICAN INSTITUTE OF STEEL CONSTRUCTION)

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

B 20.1 "Safety Standard for Conveyors and Related Equipment"

ANSI/CEMA (AMERICAN NATIONAL STANDARD INSTITUTE/CONVEYOR EQUIPMENT MANUFACTURERS ASSOCIATION)

ANSI/CEMA 102 "Conveyor Terms and Definitions"
ANSI/CEMA 550 "Classification and Definitions of Bulk Materials"
ANSI/CEMA 502 "Troughing and Return Idlers"

ANSI/MPTA (AMERICAN NATIONAL STANDARD INSTITUTE / MECHANICAL POWER TRANSMISSION ASSOCIATION)

ANSI/MPTA 301 "Welded Steel Conveyor Pulleys"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

IPS (IRANIAN PETROLEUM STANDARDS)

E-GN-100 "Units"

3. CONFLICTING REQUIREMENTS

In the case of conflict between documents relating to the inquiry or order, the following priority of documents shall apply:

- **First priority:** Purchase order and variations thereto.
- **Second priority:** This Standard specification.

All conflicting requirements shall be referred to the Purchaser in writing. The Purchaser will issue confirmation document if needed for clarification.

4. UNITS

This Standard is based on International System of Units (SI), except where otherwise specified.

5. DESIGN

5.1 General

5.1.1 Conveyor terminology in design shall be in accordance with ANSI/CEMA Standard No. 102.

5.1.2 The classification and definition of bulk materials to be conveyed in design shall be employed in accordance with ANSI/CEMA Standard No. 550.

5.1.3 The speed and width of the belt on the conveyor shall be determined on the basis of the specified volume, apparent specific gravity of the bulk materials to be conveyed and angle of repose on the belt.

5.2 Belts

5.2.1 Belts shall be sized to convey the material at the design mass flow rate based on the lowest specified bulk density of the material to be conveyed.

5.2.2 Belt covers shall be CEMA Grade 2, designed for the material conveying temperature.

5.2.3 Belt troughing idler angle shall be 35°.

5.2.4 Belts as initially installed shall have no mechanically fastened splices, and not more than one vulcanized splice shall be used for belt installation in the field.

5.2.5 Tension rating of belting shall be based on a mechanical splice.

5.2.6 A return-belt-cleaner plow shall be provided for conveyors without decking.

5.3 Pulleys

Welded steel conveyor pulleys shall be used and designed in accordance with ANSI/MPTA 301, and a dust proofing system and grease sealing type lubricator shall be provided.

5.4 Idlers

5.4.1 Troughing idlers shall be of the three equal-length-roll type.

5.4.2 Idler selection (CEMA series number classification) shall be based on the type of service specified. i.e., continuous or intermittent, taking into account the frequency and duration of operation.

5.4.3 Idlers shall be so arranged as to allow replacement of individual idle pulleys from the walkway side of the conveyor without removal of the entire idler assembly.

5.4.4 The spacing of carrying idlers shall be determined in accordance with the belt width and the weight of material handled, and the maximum spacing shall be 1600 mm. The spacing under the loading skirt shall be closely spaced where subject to large shocks caused by the material being conveyed.

5.4.5 The transition distance from the troughing idler to the terminal pulley shall be determined in accordance with the idler angle and belt tension rating based on the belt width.

5.4.6 The spacing of return idler shall be 3000 mm for a belt having 1500 mm or smaller width, and 2400 mm for a belt with a larger width.

5.5 Take-up

5.5.1 The type of take-up devices shall be selected in accordance with the conveyor length as shown in Table 5.1.

TABLE 5.1 - TYPE OF TAKE-UP FOR BELT CONVEYOR

LENGTH OF CONVEYOR	TYPE OF TAKE-UP
Under 30 m (100 ft.)	Screw or automatic, gravity operated
30 m (100 ft.) and over	Automatic, gravity operated

5.5.2 Design of gravity take-up devices shall include the following features:

a) Provision for future addition of counter weights,
b) the counter weights shall be confined in an open mesh steel cage enclosure, extending upward from grade or floor level.

5.6 Drivers and Transmissions

5.6.1 The drive unit shall be provided in the following locations except where the optimum location may be recommended by the Vendor.

a) At the head for horizontal and ascending type conveyors;
b) at the tail for descending type conveyors.

5.6.2 Conveyors having an ascent angle of ten (10) degrees or more should be provided with a single drive unit except where the Company approves otherwise.

5.6.3 A long horizontal type conveyor may use a tandem drive unit, if the Vendor so recommends.

6. CONVEYOR ACCESSORIES

6.1 Backstop and Braking Devices

Ascending type conveyors shall be equipped with backstop devices and descending conveyors shall be equipped with braking devices.

The location of these devices shall be as follows, except where the Vendor may recommend otherwise:

a) Backstop devices shall be provided at both the drive pulley shaft and electromotive axle.
b) A braking device shall be provided at the tail pulley.

6.2 Pull Cord Switches

6.2.1 Conveyors shall be provided with emergency pull cord switches, unless otherwise specified.

6.2.2 The pull cord shall extend along the entire length of the conveyor.

6.2.3 The maximum space between pull cord switches shall not exceed 30 m.

6.2.4 The pull cord switches shall be provided with manual resetting at the location, where the emergency stop has been initiated.

6.3 Belt Cleaning Device

A return-belt-cleaner plow which meets the characteristics of the material to be conveyed shall be provided for the conveyor belt.

6.4 Chute and Feeder

Shape and structure of chutes and feeders shall be appropriately designed, based on the characteristics and usage of materials to be conveyed except where the type may conform to manufacturer's standard.

6.5 Tripper and Scraper

A suitable tripper or scraper shall be used when unloading materials from intermediate points on the belt. Manufacturer's standard can be used if applicable.

6.6 Conveyor Covers and Decks

6.6.1 Half-covers shall be provided on all outdoor installations of belt conveyors.

6.6.2 Conveyor decking shall be provided at the loading point, and forward of it for the next 15 m. The design shall make provisions for future addition of decking.

6.7 Nameplate

6.7.1 A nameplate made of stainless steel shall be attached on a visible portion of the conveyor indicating belt speed, rated horsepower etc.

6.7.2 A tag plate indicating the direction of belt pulley rotation by an arrow shall be provided near the driver.

7. STEEL STRUCTURES

7.1 Frame

The frame for supporting the machinery components of the conveyor shall be designed in accordance with AISC Standard.

7.2 Platforms, Walkways

7.2.1 Platforms shall be provided in convenient locations for the operation and maintenance of the belt conveyor.

Grating shall be used for platform flooring, except along those sections of the conveyor furnished with decking. In such cases, the floor plate shall be checkered plate.

7.2.2 Walkways shall be provided as follows:

a) Along the entire length of the conveyor which cannot be maintained from the operating platform and in all locations where the belt top elevation exceeds 2000 mm from the grade or platform.

b) Along one side only for a conveyor belt less than 1000 mm in width and along both sides for a conveyor belt being 1000 mm or over in width.

c) Hand railing and toeplates shall be provided on walkways along the outside edge (farthest from the belt).

d) Across belt conveyors as required to permit access for operation and maintenance, and where the conveyor layout interferes with grade level pedestrian accessways.

8. MATERIALS

Materials to be employed in the manufacture and fabrication of components of the conveyor shall comply with the ASTM Standard specifications or equivalent.

9. SAFETY

9.1 Belt conveyors shall be designed with safety provisions for the protection of operating personnel, in accordance with safety standards for conveyors and related Equipment ANSI B 20.1.

9.2 The constructional features and quality of belt conveyors shall be determined on the bases of their intended service life and condition of usage.

9.3 The belt conveyors shall be capable of operation within the specified noise limits.

10. INSPECTION AND TESTING

The conveyors completed in the fabrication shop or field assembled shall be subjected to the following inspections and tests after being assembled.

a) Visual and dimensional check of assemblies
b) Noise level check under no load conditions
c) Running test and performance test of assemblies
d) Safety device check under no load conditions

11. PREPARATION FOR SHIPMENT

11.1 Equipment shall be suitably prepared for the type of shipment specified. The preparation shall be mutually agreed upon and unless otherwise specified, shall make the equipment suitable for 2 years of outdoor storage from the time of shipment.

11.2 The Vendor shall provide the Purchaser with the instructions necessary to preserve the integrity of the storage preparation after the equipment arrives at the job site and before start-up.

11.3 One copy of the manufacturer's standard installation instructions, operation/maintenance manual shall be packed and shipped with the equipment.

11.4 Each part of the equipment shall be suffixed with a metal tag indicating its name and part number to facilitate assembling.

In addition each package shall be tagged with packing list.

11.5 Unless otherwise specified, separate shipment of equipment is not allowed.

12. GUARANTEE AND WARRANTY

Unless exception is recorded by the Vendor in his proposal, it shall be understood that the Vendor agrees to the following guarantee and warranties:

During a period of 12 months after the date of commissioning, the Vendor shall, with all possible speed and without cost to the Purchaser, replace or repair the goods or any part thereof found to be defective due to faulty material workmanship or to any act or omission of the Vendor. In the particular the Vendor shall reimburse any transportation and other charges incurred by the Purchaser in effecting such replacement or repair at the point of use.

APPENDICES

APPENDIX A
INFORMATION TO BE SUPPLIED WITH INQUIRY OR ORDER

The following particulars will enable the manufacturer to select the most suitable equipment from his production range to suit the proposed application:

1) Bulk density of the material to be conveyed.

2) Any special operational conditions (such as in high temperatures, or in dusty, corrosive or abrasive atmospheres, or in humid or wet conditions, or on exposed sites).

3) Electric supply characteristics.

4) If possible, a sketch of the proposed layout, with such details as available clearance heights.

APPENDIX B
INFORMATION TO BE SUPPLIED BY MANUFACTURER BEFORE PLACING THE ORDER AND VENDOR DATA REQUIREMENTS AFTER RECEIPT OF ORDER

B.1 Information to be Supplied by Manufacturer before Placing the Order

Prior to placing purchase orders for conveyor system, components, detailed drawings or data for the following shall be submitted:

a) Device for cleaning the conveying surface of the belt.
b) Length or each type and size of belt to be furnished for field splices.
c) Type and location of the following idlers:

  1) Impact idlers at loading points.
  2) Training idlers for top and bottom runs.
  3) Self-cleaning type return idlers.
  4) Transition idlers.

d) Seal and lubrication design for the idler bearing.
e) Drive pulley and lagging design.
f) Pulley bearing design.
g) Acceleration/deceieration control devices.
h) Structural provisions for future addition of decking.
i) Splicing procedure and special devices (if any) shall be supplied by the Vendor.

B.2 Vendor Data Requirements after Receipt of Order

Vendor shall furnish the following data in the number of copies and in the number of calendar days agreed upon by the Purchaser after receipt of order. Certified data shall be submitted within thirty (30) calendar days after return of approval for data.

1) Equipment general arrangement DWG.
2) Outline dimensions.
3) Cross sections.
4) Foundation layout, anchor bolt details, etc.
5) Wiring diagrams.
6) Instrument panel layout & dimensions.
7) Erection drawings, & diagrams.
8) Instrument installation DWG's.
9) Bill of materials.
10) Complete part list.
11) Recommended spare parts for 2 years of operation.
12) Recommended spare parts for Commissioning.
13) Completed specification sheets giving manufacturer, size, type of model and specification of equipment.
14) Instructions-installation, operation, and maintenance manual as requested.