The following notes are presented in order to assist users to achieve maximum economy and convenience with the installation of cable support systems. As each application will have its own particular conditions and requirements it is recommended that the services of Unistrut sales personnel and engineering team be engaged, especially in the early stages of any major project, so that the best overall result can be achieved.

Standard Sizes

Standard ladder widths are 150mm, 300mm, 450mm and 600mm, being the inside dimension between side-rails and is the maximum width available for carrying cables. Straight lengths are 6m long. Standard rung spacing on all systems is 300mm nominal.

Each of the Unistrut systems includes a full range of standard accessories, with a nominal radius of 300mm, 450mm and 600mm, depending on the system load class. Non-standard ladder widths and accessory radii can be manufactured against order.

Load Capacity

a) **Cable Load** – Because the cable density remains fairly constant in a total installation, the widest ladders carry the most load, and each smaller width carries proportionately less load. However, the load carrying capacity of any class of ladder is independent of the width.

   For details on how safe working loads are determined, refer to the NEMA VE 1 Standard and to the published load graphs for allowable loads of each ladder type.

b) **Fixed Ladder Spans** – It is commonly found that the building structure supporting the cable ladders will dictate the span, but it is still possible to exercise some choice. Where the cabling is heaviest, and this is not usually extensive, it is possible to use (say) two 300mm wide ladders side by side instead of one 600mm wide, in order to select a lighter category of ladder for the total project. It is often inconvenient to use more than one ladder category in the same installation.

c) **Varying the Spans** – Where the structure does not dictate the ladder span, the heaviest cable runs could be supported more frequently, again enabling a lighter category of ladder to be chosen.

Cable Laying Depth

Each of the Unistrut Cable Ladder and Tray Systems has a different cable laying depth. It is a general rule that the shallower the ladder, the lower the cost per metre and the more frequently it needs support. It is sometimes found that the lightest, most economical ladders are excluded from consideration solely because a particular minimum cable laying depth is required and has been specified accordingly.

Deflection

Cable ladders are essentially structural members designed to strength requirements only and are required to support pliable load elements. Therefore, the control of deflection is not necessary for durability or stability reasons and can probably only be justified on purely aesthetic grounds. If normally accepted deflection limits such as 1/360th of span are imposed, the resultant cable ladder will be grossly over designed and correspondingly expensive.

There may still be locations where the designer wishes to limit visual deflection. For example, prestige areas which may be open to public view or where the ladder is installed at eye level and deflection is accentuated. If these conditions exist, it is recommended that closer support spacings be used only in those important locations (to control visual deflection) and normal support spacings elsewhere (for economy). A maximum of 1/180th of span, when deflection is determined from the graphs published in this catalogue, should prove a satisfactory limit for visual deflection.

Otherwise, wherever overall economy is the principal consideration, no limits should be placed on deflection. This does not mean that deflection will be excessive but simply that a typically acceptable installation will result and optimum economy will be attained.

Material Selection

Often the most difficult decision to be made is the selection of material, because it involves the most cost-sensitive of compromises. Material choice is directly related to service life and the longer the required life the more expensive will be the materials. The cost of these materials also must be considered as an equation of initial investment versus maintenance costs and eventual replacement.

Because service conditions for cable ladders can vary over an enormously wide range, even within a single installation, it is impossible to write down any hard and fast rules on the subject of corrosion and expected lifespan. The following may be considered a guide as to what can be expected from the various materials and finishes currently available for cable support systems.

a) **Galvanised Steel** – Hot-dipped galvanised steel (after fabrication) is a common selection, as it is economical to purchase and suitable for most conditions of outdoor exposure. For indoor applications, or anywhere that is essentially free from moisture, galvanised ladders can be considered to have an indefinite life. That is, they should last as long as the plant, building, cabling or equipment which they service.

On a typical industrial or processing plant installation, exposed to weather, moisture and airborne industrial pollution, a basic life of approximately ten years can be expected. This is not to say that the ladder will be completely corroded in that time but it is the probable life of the corrosion protection finish. Beyond that time, rapid decay can be expected and maintenance costs will increase substantially in order to keep the ladders serviceable.

The ten year life quoted here should be adjusted up or down depending on the circumstances. For example, if installed near the coast, the effect of salt laden air may shorten the expected life. Also galvanising is sensitive to some chemicals, especially sulphurous compounds, which may be intrinsic to plant operations where the ladder is installed. Correspondingly, a longer life will be expected in lighter industrial situations and if drier conditions exist.

b) **Aluminium** – Aluminium is also a popular choice of material for cable ladders. Most frequently it is selected because of its excellent performance in marine environments such as is found on wharves, coal loaders or similar Port Facilities where salt spray or salt laden atmosphere is present. Another reason for using aluminium is that it offers a long maintenance free life which is important in cases where access for future painting or repairs may be costly and difficult.

For any given load class or capacity, aluminium cable ladders are more expensive than their galvanised steel counterparts. Aluminium ladders can also be expected to have a greater deflection than an equivalent steel system. On the other hand, they are lighter, more readily handled and are easy to work with, resulting in faster installation and therefore lower installation cost.

Aluminium cable ladders can be expected to have a lifespan well in excess of twenty years in most industrial or marine applications. The exception would be in the case of a local concentration of chemicals which are detrimental to aluminium. Alkaline compounds or fumes is a common example but if any doubt exists, the advice of aluminium suppliers should be sought.

c) **Powder Coating or Paint Systems:**

1. Coating on bare steel.

Painting over bare steel is not generally recommended for cable ladders. This comment applies to virtually all types of 'organic' or non-metallic coatings such as powder coatings, polyesters, PVC or nylon. Although these coatings are resistant to a wide variety of chemicals, their effectiveness on cable ladders can be limited. The non-sacrificial nature of paint films means that anywhere the coating is broken, corrosion is permitted to obtain a foot-hold. It is then able to spread rapidly underneath the paint, lifting it off and allowing corrosion to progress even further.

If it is decided to use a paint or powder coating on bare steel, then before commissioning, a compatible repair paint should be used to make good any places on the ladder installation that my have been damaged during erection.

2. Coating over Galvanised Steel or Aluminium

Application of paint systems over either of the above materials is obviously a more expensive approach, but in some circumstances it is the only answer. If ladders are installed in close proximity to acid tanks, process vats, steam pipes or similar situations, there may be no metallic finish capable of giving satisfactory service life. This can be overcome by the application of a suitable paint or powder coating over galvanised or aluminium base materials. Naturally, in order to contain costs, the additional finish need only be applied to those sections of the work which are effectively exposed to the corrosive fumes.

d) **Stainless Steel** – Stainless Steel is sometimes considered as a material for cable ladders, usually where extremely high corrosion resistance, coupled with difficulty of servicing after installation and a high degree of reliability are essential requirements. An off-shore oil drilling platform may be one example where these conditions exist.

The NEMA Standards

NEMA STANDARD No. VE 1 is published by the National Electrical Manufacturers Association in the U.S.A. The Standard provides for the technical requirements of construction, performance and testing of cable tray systems. It is regularly revised by the Association in order to keep pace with technology and the ever changing requirements of the manufacturers, contractors, consultants and other users throughout the electrical industry.

There is presently no Australian Standard governing cable support systems. Despite the existence of other versions from places such as Canada and Europe, the NEMA VE 1 is by far the most widely accepted and the best known Standard for cable supports in Australia. In recognition of this situation, and in order to produce cable ladders of known quality and load capacity, Unistrut has adopted a policy of constructing and rating its cable support products in accordance with the VE 1 Standard wherever possible. This policy is reflected in the name and various class designation numbers now used by Unistrut which are drawn directly from the Standard. For example NEMA Class 12B, 16A, 20B or 20C. Please note that in most cases Unistrut ladders exceed the minimum strength requirements of each ladder class and therefore the published load graphs should be consulted in order to find the actual safe load capacity for each ladder type.

The more important aspects of the NEMA Standard VE 1 which are relevant to Unistrut products are described as follows:

1. Load Capacity and Safety Factor

   Safe working loads are required to be determined as a result of testing a series of sample ladders. Tests must be conducted as simple spans (ie the worst case for loading) and over various span lengths with a safety factor of 1.5 against the collapse load of the ladder. In this way, loads are based on average performance of a number of samples and not just a single test or some calculations. The Standard does not permit working loads to be determined by calculation because it has proven to be too unreliable. Cable ladders are specialist products which are unconventional in the structural sense. That is, they have an unusual combination of slenderness, local buckling of thin material and overall lateral restraint elements which are not satisfactorily intepreted by normal design methods.

2. Deflection

   The NEMA Standard VE 1 does not specify any limitation on the deflection of cable support members. To do so, would inevitably result in an over-designed (and hence uneconomical) system. For further information on deflection please refer to notes under Guidelines for Ladder Selection.

3. Electrical Continuity

   The electrical resistance of connections is limited to a maximum of 330 micro-ohms. Representative samples of Unistrut splice joints (both steel and aluminium) as well as the rung to side-rail joint in aluminium ladders have been tested by an Independent Electrical Laboratory, and in all cases were found to comply with the NEMA Standard VE 1 specification.

Explanation of NEMA VE 1 load/span class designations

The NEMA VE 1 rating method is based on the Imperial system of measurement, as follows:

1. The numerals indicate the ladder span in feet.

8	=	8ft (2.4m)
12	=	12ft (3.6m)
16	=	16ft (4.8m)
20	=	20ft (6.0m)

2. The letter indicates the working load category.

A	=	50lbs/lin.ft (75kg/m)
B	=	75lbs/lin.ft (112kg/m)
C	=	100lbs/lin.ft (149kg/m)

Example: A 20B class ladder requires a minimum safe working load of 75 lb/ft. over a 20ft.span. (ie.112kg/m over a 6.0m span)

Steel Cable Ladder (SCL)

Galvanised steel cable ladders are the most popular format for cable support systems as they afford a good combination of cost, strength and service life. Unistrut manufactures a complete range of NEMA Steel Cable Ladder systems. These provide a wide range of load and span combinations to suit the requirement of almost any installations.

Side-Rail Alternative - With the exception of Nema 12B, all ladder systems are available with the side-rails turned outward (as standard), or inward (RI) to meet varying client specifications.

All ladder systems are load rated to NEMA Standard VE 1.

Stainless Steel - In cases where extremely high corrosion resistance is required, stainless steel cable ladder may be the only solution. All steel cable ladder systems are available in stainless steel on special order only. For load and deflection calculations, contact your local Unistrut Service Centre.

Splice Plates

16A, 20B and 20C Systems - Unistrut steel splice plates are of a robust and practical design. The neat fitting flanges and bolted configuration of Unistrut splices also reduces deflection at joints as the ladder is loaded. Unsightly dips or discontinuities along the ladder run are therefore avoided. Bolt holes in splice plates and ladder side-rails are elongated so that site misalignments as well as thermal expansion and contraction are catered for.

12B Systems - The 12B splice plate incorporates virtually all of the working features as described for the 16A, 20B and 20C ladders, but because the 12B is a lighter duty system, a simplified splice design is used. Requiring only two fixing bolts and eliminating the need for matching holes in the side-rail, the 12B splice plate is convenient in use and extremely fast to install.

Notes - *Electrical resistance across splice joints is less than the 330 micro-ohms limit specified by NEMA Standard VE 1. To attain maximum working load of the system, the following recommendations should be adopted.*

- Do not splice single spans of ladder.
- Avoid splice joints in the vicinity of the end supports on continuous runs.
- Avoid splice joints directly over intermediate supports on continuous runs.
- Locate splice joints at the quarter span point between supports on continuous runs.

If in doubt, please consult your Unistrut Service Centre.

Accessories – All Unistrut steel cable ladder systems are complemented by a full range of standardised fabricated accessories and fittings which are readily available. All are of a welded construction.

Built-in Splice - The principal feature of all Unistrut cable ladder accessories is the 'built-in' splice plate. A shaped extension of the accessory side-rail permits direct connection to the straight ladder eliminating the need for a separate splice component. The advantages of this method are:

- Minimised fixing hardware and components.
- When joining to a cut ladder, the accessory end acts as a convenient drill template for bolt holes.
- Simplifies pre-planning, quantity take-offs and ordering.
- No left-over components.
- Strong and rigid joint.
- Faster installation.

Accessories are attached with the same fasteners as used for straight splice plates.
Threaded fasteners are hot dipped galvanised.

Elongated slots allow easier fit-up and permit adjustments in alignment to be absorbed.

Construction

Unistrut steel cable ladders are manufactured from steel to AS/NZS1594 "Hot-Rolled Steel Flat Products" which are cold roll formed to the desired shape. The roll forming process improves the mechanical properties of the metal whilst the special lipped channel section is designed to give the best possible combination of strength-to-weight, lateral rigidity and low deflection. The rungs are fillet welded to the side-rails which further improves the overall stability as well as strength of the finished product. The rung joint is so designed that galvanising can be effected to all areas.

Ladders, accessories and other galvanised components are hot-dipped galvanised to AS/NZS 4680 / BS EN ISO 1461:2009, after fabrication.

NEMA 12B Straight Tray [HG]

Cable Laying Depth: 44mm

Loading Data:
Basic Load Capacity
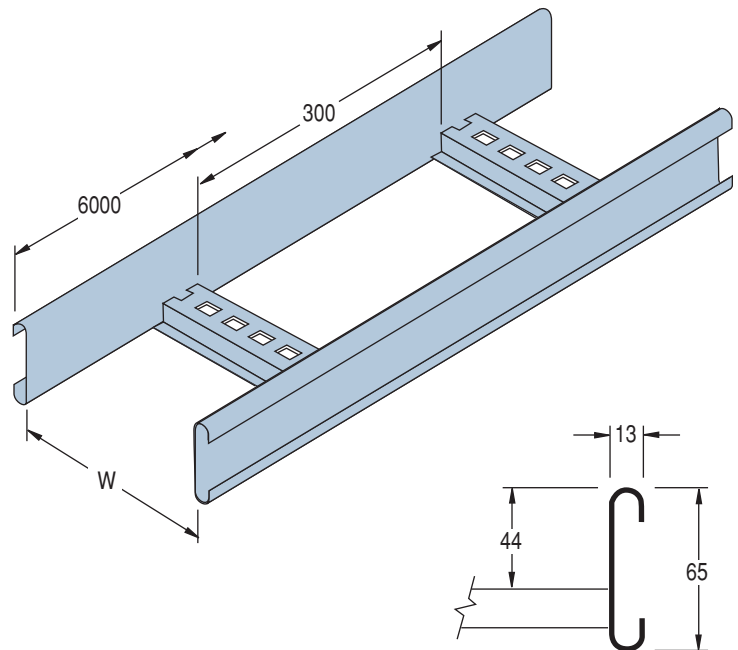112kg/lin.m on 3.6m span

Length: 4m & 6m

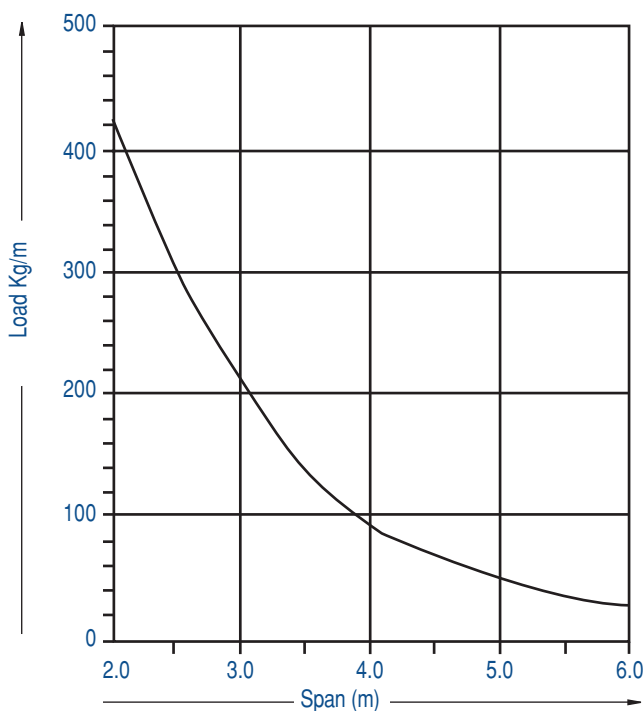**Rung Spacing:** 300mm nominal

Standard Finish: Hot Dipped Galvanised

*Also available in Stainless Steel
(3m length, part no. LUE)*

Dim "W"	Type	Part No.	
		4m	6m
150	12B	**LEE101**	**LEE1016**
300	12B	**LEE103**	**LEE1036**
450	12B	**LEE104**	**LEE1046**
600	12B	**LEE106**	**LEE1066**

• Splice plate & fixing screws are not included (order separately).

Allowable Load Graph

Allowable loads are determined generally in accordance with
NEMA Standard VE1 and verified by testing.
Safety Factor = 1.5 on collapse load for single span.

Deflection Graph
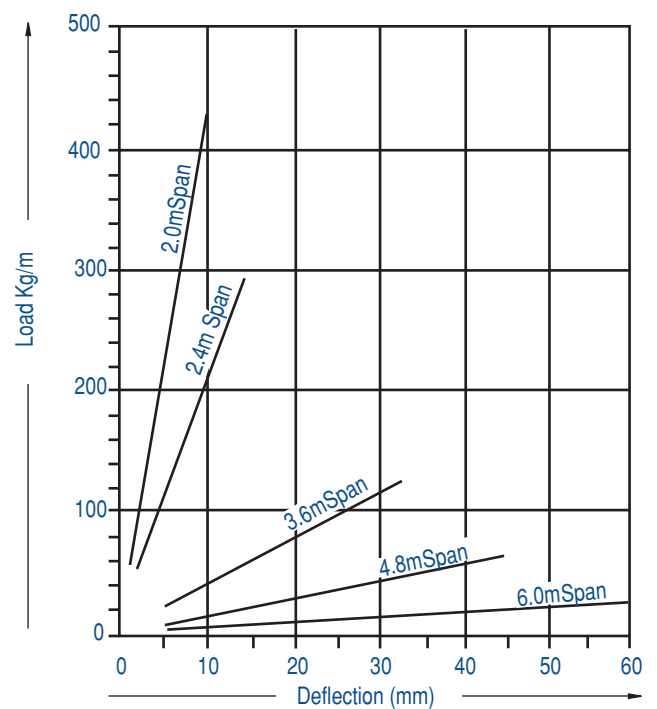
Deflections shown apply to the end-bays (ie. worst case) of
a continuous ladder run. To find deflection of a single span,
multiply by 2.5.
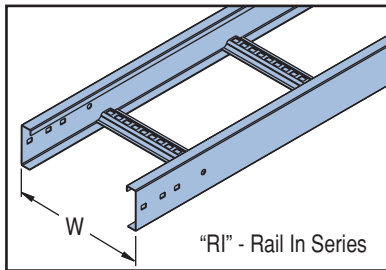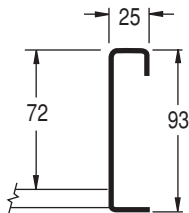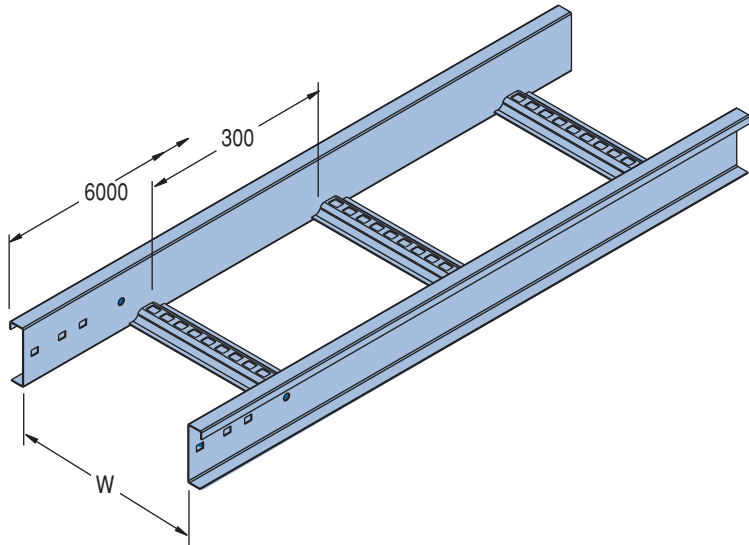
Cable Laying Depth: 72mm

Loading Data:
Basic Load Capacity
90kg/lin.m on 4.8m span
79kg/lin.m on 6m span
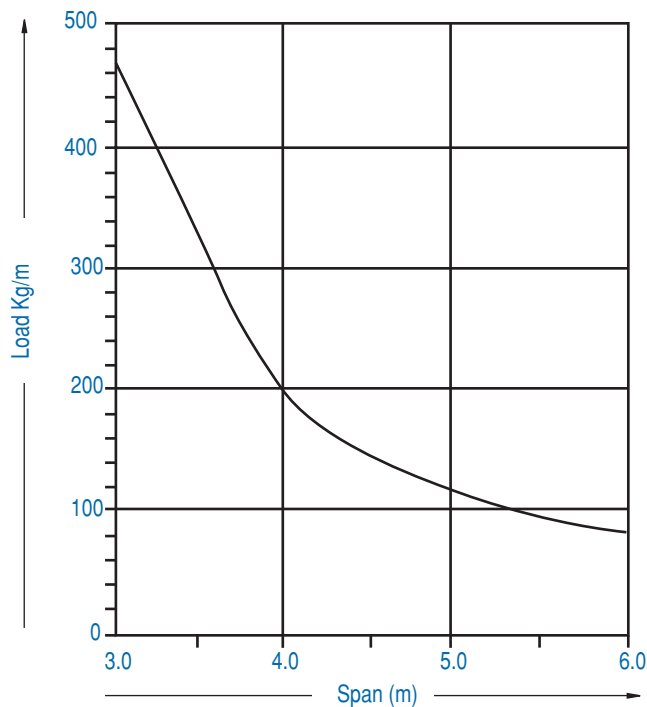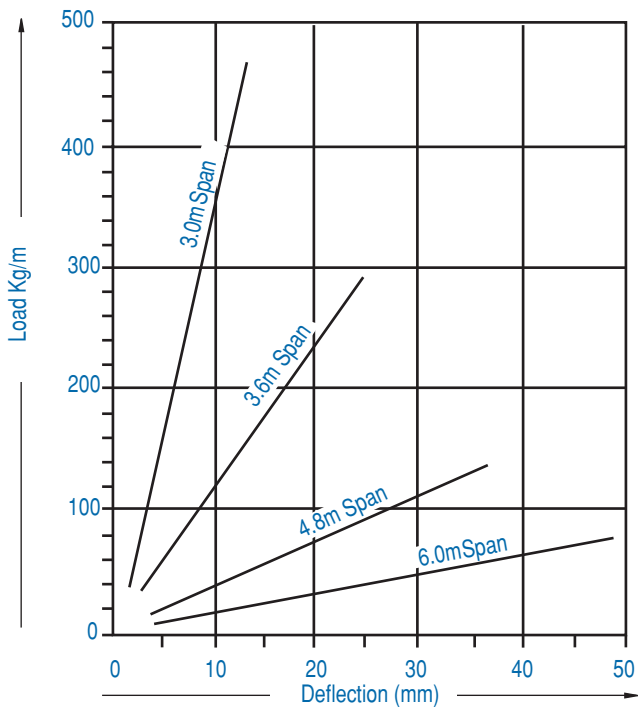
Length: 6m

Rung Spacing: 300mm nominal

Standard Finish: Hot Dipped Galvanised

Also available in Stainless Steel Grade 316
(3m length, part no. LUG)

Dim "W"	Type	Part No.
150	16A	**LEG101**
300	16A	**LEG103**
450	16A	**LEG104**
600	16A	**LEG106**
150	16A-RI	**LEG101R**
300	16A-RI	**LEG103R**
450	16A-RI	**LEG104R**
600	16A-RI	**LEG106R**

"RI" - Rail In Series

• *Splice plate & fixing screws are not included (order separately).*

Allowable Load Graph

Deflection Graph

Allowable loads are determined generally in accordance with NEMA Standard VE1 and verified by testing.
Safety Factor = 1.5 on collapse load for single span.

Deflections shown apply to the end-bays (ie. worst case) of a continuous ladder run. To find deflection of a single span, multiply by 2.5.

NEMA 20B Straight Tray [HG]

Cable Laying Depth: 109mm

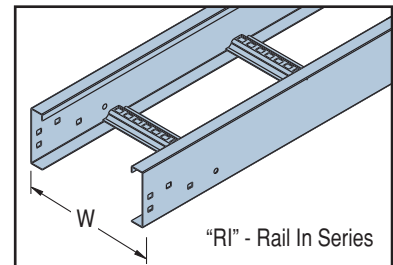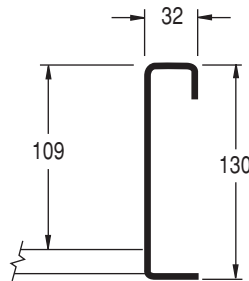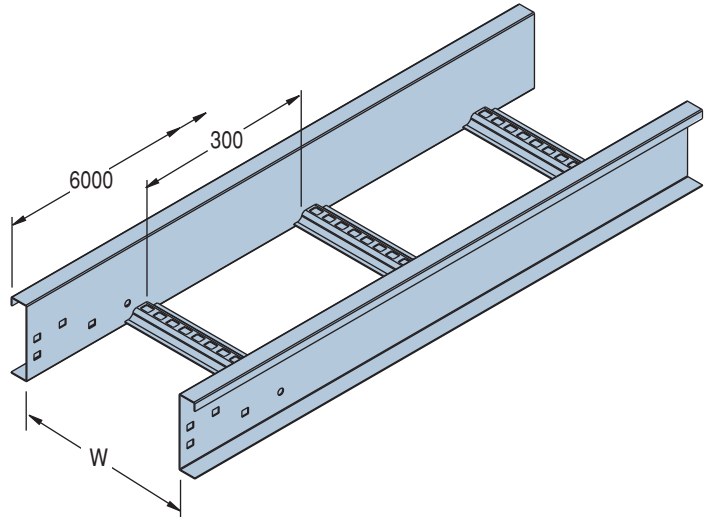**Loading Data:**
Basic Load Capacity
136kg/lin.m on 6m span

Length: 6m

Rung Spacing: 300mm nominal
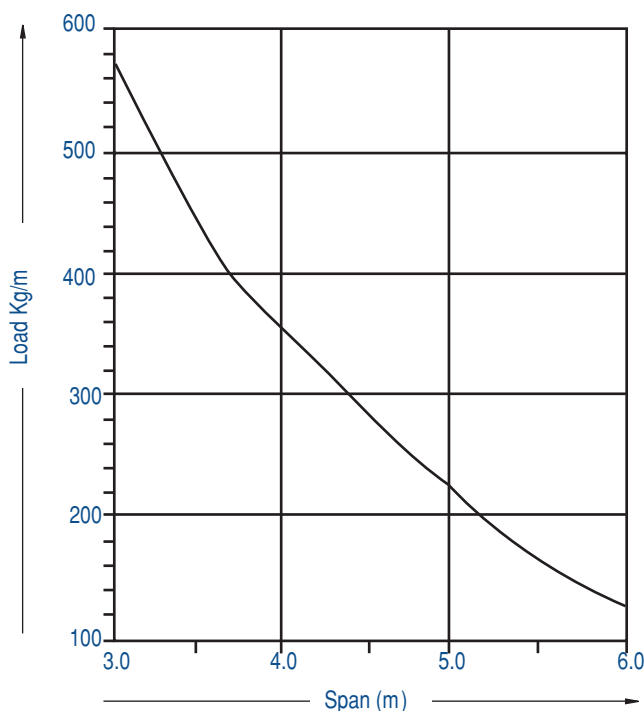
Standard Finish: Hot Dipped Galvanised

*Also available in Stainless Steel Grade 316
(part no. LUK)*

Dim "W"	Type	Part No.
150	20B	**LEK101**
300	20B	**LEK103**
450	20B	**LEK104**
600	20B	**LEK106**
150	20B-RI	**LEK101R**
300	20B-RI	**LEK103R**
450	20B-RI	**LEK104R**
600	20B-RI	**LEK106R**

6000   300   W

32   109   130

"RI" - Rail In Series

• Splice plate & fixing screws are not included (order separately).

Allowable Load Graph

Load Kg/m
Span (m)

Deflection Graph

Load Kg/m
Deflection (mm)

3.0m Span
3.6m Span
4.8m Span
6.0m Span

Allowable loads are determined generally in accordance with
NEMA Standard VE1 and verified by testing.
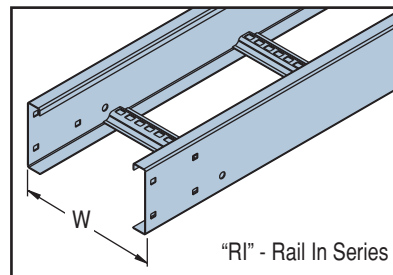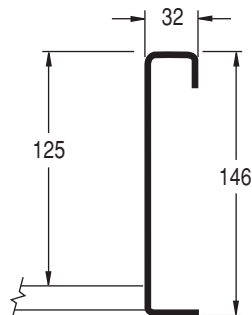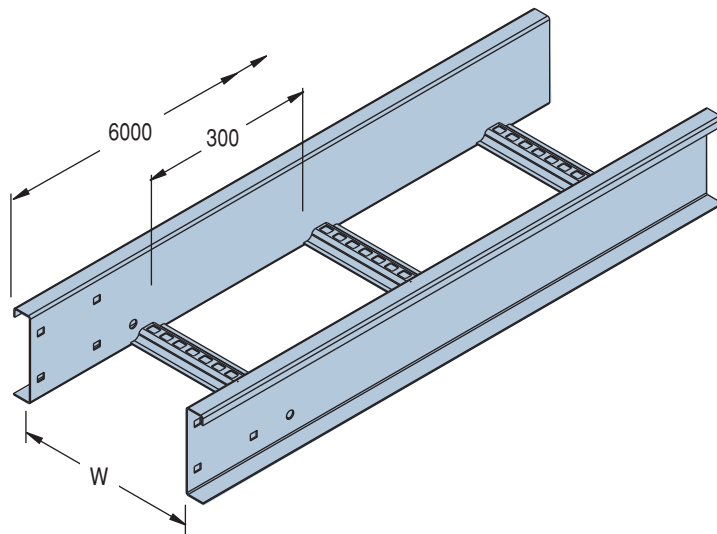Safety Factor = 1.5 on collapse load for single span.

Deflections shown apply to the end-bays (ie. worst case) of
a continuous ladder run. To find deflection of a single span,
multiply by 2.5.

6000

300

W

32

125

146

W

"RI" - Rail In Series

• Splice plate & fixing screws are not included (order separately).

Cable Laying Depth: 125mm

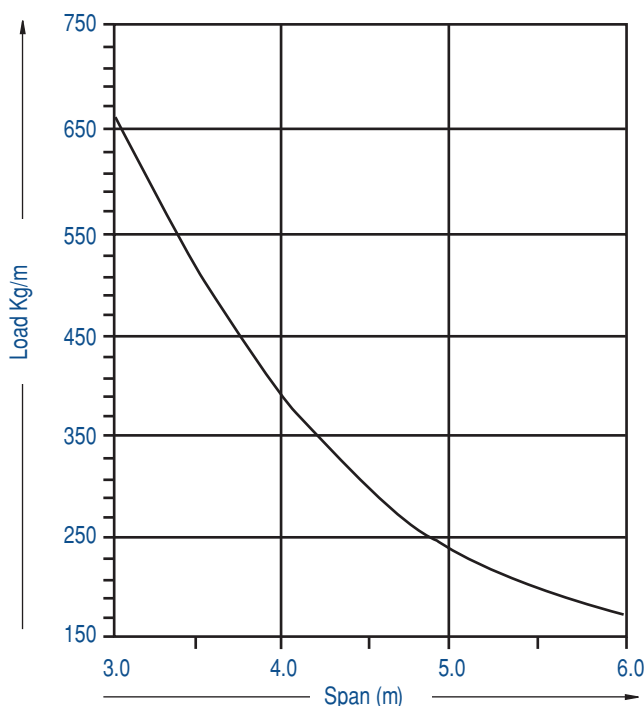**Loading Data:**
Basic Load Capacity
168kg/lin.m on 6m span

Length: 6m

Rung Spacing: 300mm nominal

Standard Finish: Hot Dipped Galvanised

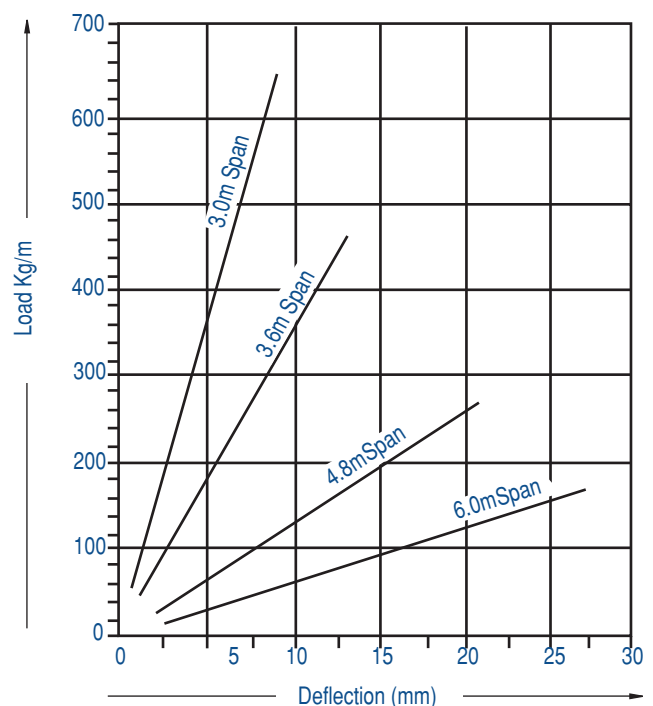*Also available in Stainless Steel Grade 316
(part no. LUL)*

Dim "W"	Type	Part No.
150	20C	**LEL101**
300	20C	**LEL103**
450	20C	**LEL104**
600	20C	**LEL106**
150	20C-RI	**LEL101R**
300	20C-RI	**LEL103R**
450	20C-RI	**LEL104R**
600	20C-RI	**LEL106R**

Allowable Load Graph

Load Kg/m

750
650
550
450
350
250
150

Span (m)
3.0   4.0   5.0   6.0

Deflection Graph

Load Kg/m

700
600
500
400
300
200
100
0

3.0m Span
3.6m Span
4.8m Span
6.0m Span

Deflection (mm)
0   5   10   15   20   25   30

Allowable loads are determined generally in accordance with
NEMA Standard VE1 and verified by testing.
Safety Factor = 1.5 on collapse load for single span.

Deflections shown apply to the end-bays (ie. worst case) of
a continuous ladder run. To find deflection of a single span,
multiply by 2.5.