

Read : Application dt.12.03.2013 and dt.07.09.2015 by M/s. Surya Multi Products Imports & Exports, holder of TIN 27060147840V.

Heard : Sh. Dattatraya Survase [Director] attended the hearing.

## PROCEEDINGS

(under section 56(1)(e) of the Maharashtra Value Added Tax Act, 2002)

No.DDQ-11-2014/Adm-6/8/B- 1

Mumbai, dt. 4/5/2016

The applicant, M/s. Surya Multi Products Imports & Exports (a Division of Surya Motels Pvt. Ltd.), situated at No.3/32, Murarji Peth, Solapur, seeks determination of the following question -

*Whether the Road Studs sold by the firm falls within the Schedule Entry No.C-54 or B-4 or E-1?*

By communication dt.07.09.2015, the following question has been posed :

*Whether the Solar Power Pavement Edge warning Light (also called as "Solar Warning Lights or Warning Blinder") sold by the firm falls within the schedule entry No.C-82?*

### 02. FACTS OF THE CASE

The application dt.12.03.2013 states thus -

- The main business of the firm "Survase's Surya Motels Pvt. Ltd." is to import Solar Energy Devices, Solar Energy System, Road Studs of glass, etc. and to sell in Maharashtra and outside Maharashtra State. The firm is also running a restaurant and Cold Storage.
- The goods of Trade of the firm are - Food, Liquor, Cold Drinks, Solar Energy Equipments, Road Studs, etc.
- Attention is invited to schedule entries thus :
  - As per Schedule "C" Entry No. C-54 - Glass frit and other glass in the form of powder, granules or flakes, Glass in the mass. The entry bears VAT at 5%.
  - As per Schedule "B" Entry No. B-4 - Glass beads. The Entry bears VAT at 1%.
- The Road Studs sold by the firm are used as reflector on Highways in night because it shines in light only. Also these studs are made from special type of glass which does not shine in daylight.
- The applicant has given copies thus -
  - Bill of Entry for Home Consumption dt.06.04.2005 showing "Solar Power Pavement Edge Warning Light (Non Electric Lighting Fitting)" cleared under Custom/Central Excise Tariff Heading 94055020.
  - Purchase invoice dt.18.03.2005 showing purchase of the product "Solar power pavement edge warning light" by the applicant from Hubei Xinbaofeng International Trade Co., Ltd., People's Republic of China.
  - Bill of Entry for Home Consumption dt.21.06.2006 showing "Road Studs" cleared under Custom/Central Excise Tariff Heading 94055059.
  - Purchase invoice dt.29.05.2006 showing purchase of the product "Road Studs" by the applicant from Chenmai County Foreign Trade Import & Export Corporation, China.
  - Sale invoice No.11/06-07 dt.29.05.06, No.73/06-07 dt.22.12.06 and No.701 dt.21.01.2010 of the applicant evidencing sale of "Solar Road Stud", "Solar Road Stud (cat eye)" and "Solar Optical Road Stud", respectively.

• A leaflet about "Solar Powered Pavement Edge Warning Light" stating thus :

#### "SPECIFICATIONS :

Solar Power : 2.5V 119 mA  
Battery : Ni-MH 1.2V 2700 mAh  
Flash Rate : 5 HZ  
View Distance: over 300 M  
Operation Time : at night  
LED : 10mm 3 & 6 pcs  
LED Colour : R/Y/B/G/W  
Materials of Shell: aluminium alloy and PC  
Fixture Body : 110(L)\*100(W)\*33(H)mm  
FEATURES :

- Green power product.
- Wireless, easy to fix.
- Automatically turns on at night and turns off at dawn.
- Convert sunlight into electricity by use of best solar cells.
- Store the electricity in first-rate battery.



Glass Road Studs Specifications:

1. Specification: Diameter 100mm\*Height50mm
2. Spherical Diameter60mm\*Height20mm
3. Glass road stud glass cat eyes
4. Material Tempered Optical Glass of Highly Crystal Silicon
5. Hardness 170±5
6. Retro Reflective Angle 360°
7. Colour White/Yellow/Red
8. Weathering Resistance Properties above 16280h
9. High quality with competitive price
10. Anti-Collision Resistance Properties above 20MT

Reflective Glass Road Studs provide good delineation at night and as can be seen from the photographs above and below, in the most hazardous driving conditions during heavy rain (where road markings become invisible), reflective road studs remain fully visible.”

By application dt.07.09.2015, attention is invited to yet another schedule entry thus :

- As per Schedule “C” Entry No. C-82 - Renewable energy devices and spare parts as may be notified, from time to time, by the State Government in the “Official Gazette”. Notification No. VAT-1505/CR-119/Taxation 1, 1<sup>st</sup> April, 2015. The Entry bears VAT at 4%.
- The Solar Power Pavement Edge Warning Light, also called as “Solar Warning Lights of Warning Blinker” sold by the firm are used as reflector on Highways in night because it shines in night only.
- The applicant has given copies thus -
  - Copy of Bill of Entry for Home Consumption dt.05.01.2006 showing “Solar Warning Blinker” cleared under Custom/Central Excise Tariff Heading 94055059.
  - Purchase invoice dt.01.12.2005 showing purchase of the product “Solar warning blinker” by the applicant from Guangzhou Pearl Industrial and Trading Co., Ltd., China.

### 03. HEARING

Sh. Dattatraya Survase [Director] attended the hearing on dt.09.09.2015. It was brought to their notice that the invoices tendered for determination are of 2009-10 and 2006-07. Hence the applicant was asked to submit a sale invoice for an unassessed period. About merits of the case, it was submitted thus :

- The product would be covered under the entry C-82 under clause (10) of the notification thereunder :  
C-82 – Renewable energy devices and spare parts as may be notified, from time to time by the State government in the official gazette.  
(10) - Solar Photovoltaic modules and panels, for water pumping and other application.
- The product is covered by the words “Solar photovoltaic modules and panels for other applications”.
- The applicant would write to the Ministry of Renewable Energy (State Government) and thereby submit a certificate that the product is a renewable energy device.
- The sale has been discontinued from 2010. Therefore, it was brought to their notice that if the periods upto 2009-10 have been assessed or notice for assessment received before application then the determination application will not fit into the scheme of section 56.

Through communication dt.15.12.2015, the applicant furnished a letter No.REN/General/Solar/4078 dt.30.11.2015 issued to the applicant by I/c General Manager (R.E.) under letter head of Maharashtra Energy Development Agency (MEDA) (A Government of Maharashtra Institution). Also copies of sale invoice No.831 dt.20.01.2011 and No.847 dt.05.03.2011, of the applicant, evidencing sale of “Solar Road Stud” were submitted. The aforesaid letter of MEDA states thus:

*“With reference to above subject, we have received your letter regarding the Type/category of Solar Stud. In this context, we would like to inform you that the Solar Stud (solar off-grid decentralized application) comes under the Solar Photovoltaic Category.”*

The applicant was asked to submit information on the following points :



- The components of the impugned road studs
- The working mechanism of such components in the impugned road studs
- Since invoices were submitted for the period 2010-11, whether the assessment proceedings for the year 2010-11 were initiated or completed?

The above questions were replied by letter dt.15.12.2015 thus :

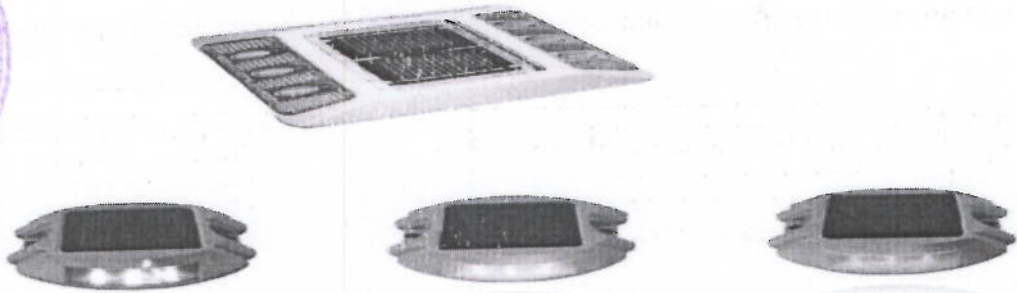
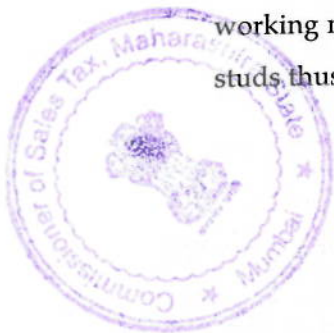
- It was informed that the product body is made of the metal aluminum. In it, 6 LED lights are fitted. There is a red coloured plastic cover on both the sides. On the upper side, Solar module (Photo-voltaic solar panel) is fitted and there is a solar battery beneath it. There is a sensor between the solar module and the battery.
- On sunrise, the battery gets charged by the sun rays through the solar module and as night sets in, the LED lights are switched on by the sensor and there is illumination. Hence, when these products are fitted on the roads, the light therefrom helps avoid accidents.
- The assessment for the F.Y 2010-11 is not completed.

#### 04. OBSERVATIONS

I have gone through the facts of the case. The product for determination is a 'road stud'. It has been informed that the Solar Power Pavement Edge Warning Light are also called as "Solar Warning Lights of Warning Blinker". Since the products are imported from outside the country, the applicant has tendered a few copies of the Bill of Entry for Home Consumption which describe the product thus :

Bill of Entry for Home Consumption dt.	Description	Customs Tariff Heading
06.04.2005	Solar Power Pavement Edge Warning Light (Non Electric Lighting Fitting)	94055020
21.06.2006	Road Studs	94055059
05.01.2006	Solar Warning Blinker	94055059

In some of the invoices, the applicant has described the product as "Solar Road Stud (cat eye)" and "Solar Optical Road Stud". On this very page, in the immediate paras above, the product and the working mechanism has been described. It would be helpful to look at the pictures of these road studs thus :



The Wikipedia describes a solar road stud thus :

*Solar road studs are flashing solar cell powered LED maintenance-free lighting devices used in road construction to delineate road edges and centrelines. Embedded in the road surface, they are an electronic improvement on the traditional cat's eyes in that they may give drivers more than a thirty-second reaction window compared with about 3 seconds for conventional reflective devices. The intense brightness of the LEDs makes them easily visible at distances of about 900 m under favourable conditions. Averaging about 100 mm square or 100 mm diameter and about 40 mm thick, units are extremely robust to avoid damage by passing vehicles, and are normally constructed of engineering plastics and polycarbonates. Use of solar road studs reduces the necessity of headlight main beams and the accompanying hazard of dazzling oncoming drivers. They are also more visible in rain and fog conditions where the old type retroreflectors and road markings are problematic. The solar cells charge batteries or capacitors during sunlit hours, over which period the flashing LEDs are turned off by a photoswitch.*

The description by the applicant, of the product, resembles the above. The above description says that during the sunlit period i.e. during day time, the LEDs are turned off by a photoswitch. A Photoelectric Switch could be understood thus :



<http://www.dictionaryofengineering.com>

A switch in which the presence of light, or the intensity of incident light such as that of a modulated light beam, determines the opening or closing of a circuit. A photoelectric switch incorporates a photoelectric device, such as a photocell. An example is a photo SCR. Also spelled photo-electric switch. Also called photoswitch, light-activated switch, or light-operated switch.

**wikipedia**

"A photoswitch, or photo-electric switch, is a sensor that detects the presence in or change of light. A popular example is that of azobenzene. Photoswitches are one type of molecular machines, a class of molecules that can be switched between at least two distinct thermodynamically stable forms by the application of an external stimulus. Development of such devices is crucial in the framework of the field of nanotechnology.<sup>[1]</sup> nowadays photoswitches are used in a variety of places from scientific applications to residential light timers.

A photoswitch molecule is a chemical that is sensitive in some way to light, e.g. able to turn on retina cells when exposed to light.<sup>[2][3]</sup> Some examples include AAQ, DENAQ, photochromic compounds, azobenzenes, spiropyrans, diaryletenes, fulgides, overcrowdedalkenes.

**Applications**

A photo-electric cell is connected to a circuit that measures how much electricity the cell produces and according to the setting of minimum and maximum lux level, the circuit decides and gives the output."

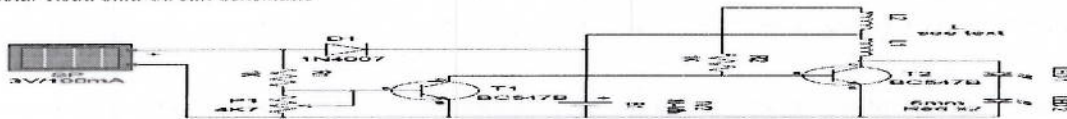
The working mechanism of a road stud could be understood thus -

<http://www.electroschematics.com>

Lanes on roads are traditionally marked in a passive way with reflecting road-studs and high visibility paint, often coupled with other reflectors on short posts at the sides of the highway. However, on busy roads with dipped headlights these "passive road studs" are harder to see, and the range of visibility is dramatically reduced, while in wet conditions they can become completely invisible. Recently some new "powered road-studs" (active road studs) have appeared as options for roadway designers, and a simple approach to the new trend is accounted here.

"Solar LED Road Marker" is nothing but an "Active Road Stud" with automatic switching function, realized using the combination of a small solar panel, re-chargeable cell, and LED driver circuitry.

Solar Road Stud Circuit Schematic



**Solar Panel:** A 3V/100 mA (0.3W) rated solar panel is used here. Such panels are widely available at a cost less than \$2. Output of the solar panel (SP1) is directly connected to the re-chargeable cell (B1) through an ordinary silicon diode 1N4007 (D1).

**Re-chargeable battery:** The power back-up mechanism is realized using a single 1.2V/820 mAh Ni-Mh battery (B1). For compactness, an AAA type is used here.

**LED Driver Circuitry:** This section is nothing, but a replica of the popular "JouleThief" circuit. Here the LED driver circuitry drives two 5mm Red LEDs (LED1 & LED2) only during night time. For automatic switching operation, one BC547 transistor (T1) is wired with the joule-thief. Associated 4K7 Preset pot (P1) can be used to alter the sensitivity of this automatic switching (day/night detector) circuit.

<http://en.szzyk.com/>

**Characteristics and working principle of ZSZM solar Road Stud**

Nowadays in China, a variety of high-tech traffic safety facilities are widely used in the projects of highway traffic safety devices. The applications of the traffic safety facilities have played their roles to improving the safety and reducing traffic accidents in highway driving. Practices proved that in rain and fog conditions, ZSZM Technology's solar road stud can outline the contours of the road and lead the drivers' sight very well and can eliminate the safety hazards. This is very important to minimize the traffic accidents. Then let's learn something about the two important features of solar stud and its working principle.

Compare to the conventional reflective stud, ZSZM solar studs have two characteristics. First is large luminous intensity. The reflected luminance of the conventional reflective studs are only 300-400mcd, while a solar studs 2000mcd which 6-7 times of the former ones. Such a high-intensity light can penetrate through the rain and fog at night and point out the correct direction for the driver safely and effectively. Second is automatic light and dynamic alert. The solar stud can flash in a certain frequency. People are more sensitive to the changes, so the dynamic light is very strong warning. The automatic light can not only minimize the interference of the rain and fog, but also reduces the necessity of vehicle lighting. They are more visible and more effective. The working principle of the solar studs can be summarized as: The solar cells charge batteries or capacitors during sunlit hours, over which period the flashing LEDs are turned off by a photoswitch then delineate road edges and centrelines.

Thus, the impugned product is a road stud which is used on roads to define the road edges and centrelines. The working is based on the solar panel which captures the sunlight which is stored in the battery and the illumination is by the LED lights. Now, there are different types of road studs as can be seen below :

<http://www.henrykemp.co.uk/road-studs/>

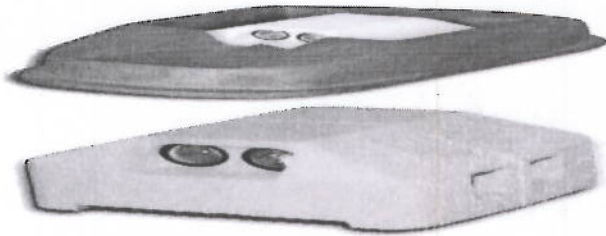
**INSET DEPRESSIBLE ROADSTUDS**

Inset depressible roadstuds consist of a flexible rubber insert with reflectors, housed inside a cast iron base. They are installed by milling a cavity into the road surface and fixing them into position with hot poured bitumen. The "depressible" part of the description means that the reflector elements housed in the rubber insert allows them to be self-cleaned by rain and the passage of traffic which causes the reflectors to pass across a wiper.

**CATSEYE (EN1463 CLASS PIB)**

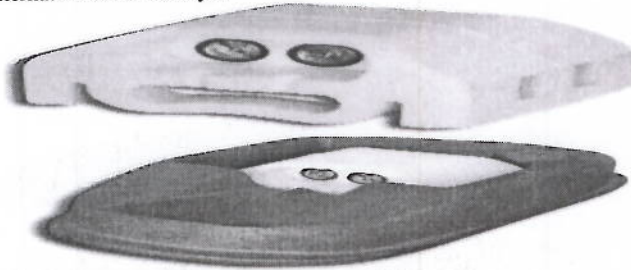
Catseyes are the world's first roadstud, created by Halifax inventor Percy Shaw who took his patent out in 1934. Since then, they have undergone several design changes to meet increasing traffic demands and keep abreast of performance requirements.





**LIGHT DOME (EN1463 CLASS P1B)**

Lightdomes are similar in many respects to Catseyes and are installed by the same method. They offer a slightly different alternative to the Catseye.



**INSET NON-DEPRESSIBLE ROADSTUDS**

Inset non-depressible roadstuds are milled into the road surface and fixed into place using molten bitumen. The reflectors are in a fixed position and rely on a combination of rain and contact with vehicle tyre treads for self-cleaning.

**ARMOURSTUD (EN1463 CLASS P1A)**

Armourstuds are a reflectorised one-piece glass construction which require a much smaller cavity to be milled into the road surface than the other inset roadstud types. The reflector principle employed in Armourstuds is catadioptric and uses internal refraction and reflection.



**ENNIS/STIMSONITE C80/381 (EN1463 CLASS P3A)**

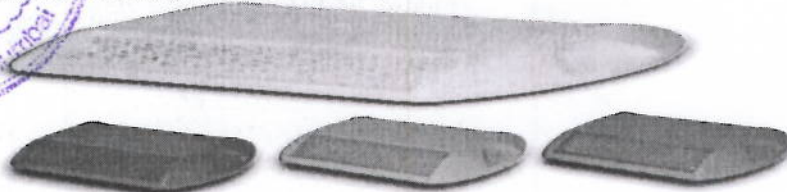
The C80/381 type roadstud consists of a fixed plastic reflector unit housed in a cast iron base. The reflectors are corner cube air gap type.



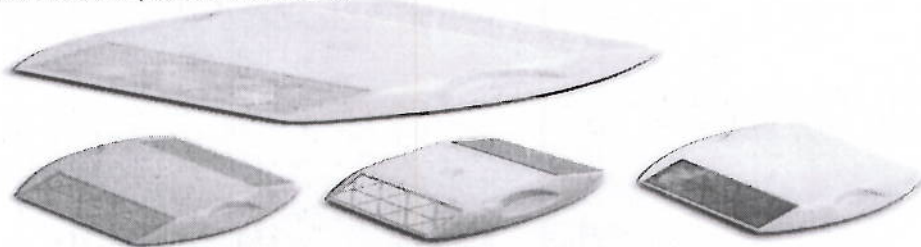
**SURFACE MOUNTED ROADSTUDS**

Surface mounted roadstuds do not require a cavity to be milled into the road surface, therefore the installation cycle is shorter than with inset studs and milling/drilling equipment is not required. This type of stud is typically made of plastic and is fixed directly to the surface using hot melt bituminous material.

**STIMSONITE 980 (EN1463 CLASS P3A)**

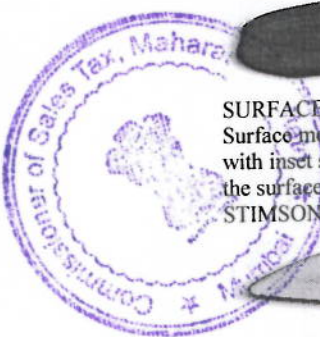


**3M TYPE 290 (EN1463 CLASS P3A)**



**ACTIVE ROADSTUDS (AKA "INTELLIGENT" ROADSTUDS)**

Active roadstuds are not dependent on vehicle headlights as the light source to be reflected back to the driver. These studs use LEDs as the light emitter. The LEDs are powered by internal batteries which are charged during daylight by solar cells. When darkness approaches the LEDs switch on automatically. This type of stud is significantly more expensive than passive types and is used in areas of poor visibility and higher accident risk.



#### ASTUCIA SOLARLITE FLUSH TYPE



#### NON-REFLECTING ROADSTUDS

Non-reflecting studs are used mostly on pedestrian crossings as a tactile demarcation for people crossing the road. They are nominally 100mm square, available in stainless steel and aluminium and are installed into small drilled holes using hot poured bitumen.

#### STAINLESS STEEL CROSSING STUDS/ALUMINIUM CROSSING STUDS



My exercise in discussing the above types is to show that the road studs are of different types. They may be solar powered studs or hardwired studs. The solar studs are the ones above. The hardwired studs require a power source. There are other varieties, as well, as discussed above. The present road stud is such that it is of the solar type. A website has described the working principle aptly thus - *it uses the sun sun's rays as the source of energy, through the solar panel to convert solar energy into electrical energy and store it into the battery inside. When night falls or with the onset of inclement weather, the solar road stud automatically starts to flash. The high brightness flashing LEDs light are highly effective at getting the attention of drivers, much earlier than conventional road studs.*

After elaborately understanding as above, let me see the claim in respect of the applicable schedule entry under the Maharashtra Value Added Tax Act, 2002 (MVAT Act,2002) as made by the applicant. I find that the applicant has laid claim to more than one schedule entries thus -

#### Schedule "C" Entry No. 54

The entry read thus - *Industrial inputs and packing materials as may be notified from time to time, by the State Government in the Official Gazette.* Under the notification issued for the purposes of this entry, it is claimed that the impugned product is covered under the description - *"Glass frit and other glass in the form of powder, granules or flakes"*. I find that this description is found in the notification against the Central Excise Tariff Heading (CETH) 3207. The notification description reads thus - *"Prepared pigments; Glass frit and other glass in the form of powder, granules or flakes"*. From the description of the impugned product as seen above, it can, without any doubt, said that the same is neither glass frit (a frit is the mixture of silica and fluxes which is fused at high temperature to make glass) nor glass in the form of powder, granules or flakes. Since the impugned product can by no means be said to be covered by the aforesaid description, I need not even discuss the aspect that the impugned product is cleared under the CETH's 94055020 and 94055059 whereas the aforesaid description is found notified against the CETH 3207.

#### Schedule "B" Entry No.4

The entry read thus - *Hairpins, Imitation Jewellery, beads of glass, plastics or of any metal other than precious metals and parts and components thereof.* It is contended that the impugned product is covered by the description 'beads of glass' as found in the aforesaid entry. It is clear and plain from the description of the product that the impugned product is not glass beads.



**Schedule "C" Entry No.82**

The entry read thus – “Renewable energy devices as may be notified from time to time by the State Government in the Official Gazette and spare parts thereof.”. The notification under the aforesaid entry notifies the following :

11	Wind mills and any specially designed services which run on wind mills.
12	Any special devices including electric generators and pumps running on wind energy.
13	Biogas plants excluding those to which entry 56A of Schedule 'A' applies and biogas engines (stove) and parts, components and accessories of biogas plants and biogas engines (stove) sold by a registered dealer who is certified by the Joint Commissioner of Sales Tax (Registration), Mumbai in the case of dealers registered in Mumbai and in all other cases by the concerned Joint Commissioner of Sales Tax (VAT Administration)..
14	Agricultural and municipal waste conversion devices producing energy.
15	Equipment for utilising ocean waves and geo-thermal energy.

Certain items (sr.no.1 to 10) in the above notification were omitted w.e.f 1st July, 2009 and notified as solar energy devices under entry 56 of Schedule A. Entry 56 was inserted in Schedule A w.e.f 01.07.2009. The same reads thus : “Solar energy devices as may be notified, from time to time, by State Government in the Official Gazette and spare parts thereof.”. The items notified under this entry are :

- (1) Flat plate solar collectors.
- (2) Concentrating and pipe type solar collectors.
- (3) Solar cookers.
- (4) Solar water heaters and systems.
- (5) Solar air heating system, solar gas heating system or solar fluid heating system.
- (6) Solar crop driers and systems.
- (7) Solar stills and de-salination systems.
- (8) Solar pumps based on solar thermal and solar photovoltaic conversion.
- (9) Solar power generating systems.
- (10) Solar photovoltaic modules and panels, for water pumping and other applications.

As can be seen, the above clauses pertain to solar energy and hence, they were omitted as a separate schedule entry was carved out for solar energy devices under the MVAT Act,2002 attracting tax @NIL%. Now, the applicant had tendered bills for the F.Y 2006-07 and 2009-10 for determination of rate of tax. Later on, the bill of the F.Y 2010-11 was tendered. Of the 15 descriptions above, it is seen that the applicant has laid claim to the description at sr. no. 10 and which is “Solar photovoltaic modules and panels, for water pumping and other applications”.

Before I embark on to discuss the correctness of the claim laid, I have to very categorically say that both the schedule entries (*Renewable energy devices and Solar energy devices*) do not cover all the devices which are Renewable energy devices or Solar energy devices. Since both the entries speak of a notification, only those devices as are notified or as are covered by the description as notified would fall in the aforesaid schedule entries. A device may be a *Renewable energy device* or a *Solar energy device*. However, if it is not notified then it would not be covered by the aforesaid schedule entries, despite being *Renewable energy devices* or *Solar energy devices*.

A plain reading of the above description reveals that it seeks to notify “Solar photovoltaic modules and panels”. The description also specifies the use to which such solar photovoltaic modules and panels would be put to. The use specified is “for water pumping and other applications”. I need not discuss the ‘use’ part of the above clause. This I say as the aforesaid notification description is very clear in its scope and intent such that it covers the “solar photovoltaic module and panel” and not the applications or the products which make use of the “solar photovoltaic module and panel”. Hence, the



question to decide is whether the impugned road studs are "solar photovoltaic modules and panels". Without any doubt, the answer would be in the negative. The impugned product is not a "solar photovoltaic module and panel" per se. It is a road stud which makes use of solar panel, LED lights, battery, sensor, etc. to form a product which is used on roads to help drive safely. A solar photovoltaic module or panel is thus :

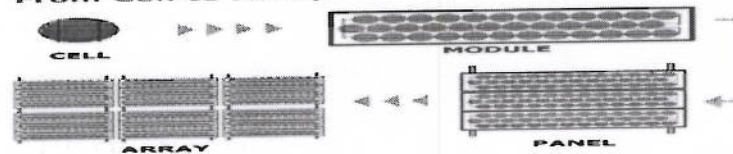
<http://www.solardirect.com/>  
Solar Electric Photovoltaic Modules



#### Photovoltaic (PV) Power

The photovoltaic effect is the basic principal process by which a PV cell converts sunlight into electricity. When light shines on a PV cell, it may be reflected, absorbed, or pass right through. The absorbed light generates electricity. In the early 1950s, photovoltaic (PV) cells were developed as a spin-off of transistor technology. Very thin layers of pure silicon are impregnated with tiny amounts of other elements. When exposed to sunlight, small amounts of electricity are produced. Originally this technology was a costly source of power for satellites but it has steadily come down in price making it affordable to power homes and businesses.

#### From Cell to Array



**Cells** Semiconductor device that converts sunlight into direct current (DC) electricity

**Modules** PV modules consist of PV cell circuits sealed in an environmentally protective laminate and are the fundamental building block of PV systems

**Panels** PV panels include one or more PV modules assembled as a pre-wired, field-installable unit

**Array** A PV array is the complete power-generating unit, consisting of any number of PV modules and panels

#### Photovoltaic Cell

A single PV cell is a thin semiconductor wafer made of two layers generally made of highly purified silicon (PV cells can be made of many different semiconductors but crystalline silicon is the most widely used). The layers have been doped with boron on one side and phosphorous on the other side, producing surplus of electrons on one side and a deficit of electrons on the other side. When the wafer is bombarded by sunlight, photons in the sunlight knock off some of excess electrons, this makes a voltage difference between the two sides as the excess electrons try to move to the deficit side. In silicon this voltage is .5 volt. Metallic contacts are made to both sides of the semiconductor. With an external circuit attached to the contacts, the electrons can get back to where they came from and a current flows through the circuit. This PV cell has no storage capacity, it simply acts as an electron pump.

The amount of current is determined by the number of electrons that the solar photons knock off. Bigger cells, more efficient cells, or cells exposed to more intense sunlight will deliver more electrons.

#### Photovoltaic Modules

A PV module consists of many PV cells wired in parallel to increase current and in series to produce a higher voltage. 36 cell modules are the industry standard for large power production.

The module is encapsulated with tempered glass (or some other transparent material) on the front surface, and with a protective and waterproof material on the back surface. The edges are sealed for weatherproofing, and there is often an aluminum frame holding everything together in a mountable unit. In the back of the module there is a junction box, or wire leads, providing electrical connections.

#### wikipedia

A photovoltaic (in short PV) module is a packaged, connected assembly of typically 6×10 solar cells. Solar Photovoltaic panels constitute the solar array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions, and typically ranges from 100 to 365 watts. The efficiency of a module determines the area of a module given the same rated output – an 8% efficient 230 watt module will have twice the area of a 16% efficient 230 watt module. There are a few solar panels available that are exceeding 19% efficiency. A single solar module can produce only a limited amount of power; most installations contain multiple modules. A photovoltaic system typically includes a panel or an array of solar modules, a solar inverter, and sometimes a battery and/or solar tracker and interconnection wiring.

<http://www.leonics.com>

#### What is Solar Cell?

Solar Cell or Photovoltaic (PV) cell is a device that is made up of semiconductor materials such as silicon, gallium arsenide and cadmium telluride, etc. that converts sunlight directly into electricity. When solar cells absorb sunlight, free electrons and holes are created at positive/negative junctions. If the positive and negative junctions of solar cell are connected to DC electrical equipment, current is delivered to operate the electrical equipment.

#### Solar cell types

There are three major cell types that classified by its manufacturing technology and the semiconductor



Crystalline Silicon PV Module: Two types of crystalline silicon (c-Si) are used to produce PV module; single crystalline silicon or known as monocrystalline silicon and multi-crystalline silicon, also called polycrystalline silicon. The polycrystalline silicon PV module has lower conversion efficiency than single crystalline silicon PV module but both of them have high conversion efficiencies that average about 10-12%.

Amorphous Silicon PV Module: Amorphous silicon (a-Si) PV module or thin-film silicon PV module absorbs light more effectively than crystalline silicon PV module, so it can be made thinner. It suits for any applications that high efficiency is not required and low cost is important. The typical efficiency of amorphous silicon PV module is around 6%.

Hybrid Silicon PV Module: A combination of single crystalline silicon surrounded by thin layers of amorphous silicon provides excellent sensitivity to lower light levels or indirect light. The Hybrid silicon PV module has highest level of conversion efficiency about 17%.

<http://www.nrel.gov> - NREL is a national laboratory of the U.S Department of Energy

#### Solar Photovoltaic Technology Basics

Solar cells, also called photovoltaic (PV) cells by scientists, convert sunlight directly into electricity. PV gets its name from the process of converting light (photons) to electricity (voltage), which is called the *PV effect*. The PV effect was discovered in 1954, when scientists at Bell Telephone discovered that silicon (an element found in sand) created an electric charge when exposed to sunlight. Soon solar cells were being used to power space satellites and smaller items like calculators and watches. Today, thousands of people power their homes and businesses with individual solar PV systems. Utility companies are also using PV technology for large power stations. Solar panels used to power homes and businesses are typically made from solar cells combined into modules that hold about 40 cells. A typical home will use about 10 to 20 solar panels to power the home. The panels are mounted at a fixed angle facing south, or they can be mounted on a tracking device that follows the sun, allowing them to capture the most sunlight. Many solar panels combined together to create one system is called a solar array. For large electric utility or industrial applications, hundreds of solar arrays are interconnected to form a large utility-scale PV system.

Traditional solar cells are made from silicon, are usually flat-plate, and generally are the most efficient. Second-generation solar cells are called thin-film solar cells because they are made from amorphous silicon or nonsilicon materials such as cadmium telluride. Thin film solar cells use layers of semiconductor materials only a few micrometers thick. Because of their flexibility, thin film solar cells can double as rooftop shingles and tiles, building facades, or the glazing for skylights.

Third-generation solar cells are being made from a variety of new materials besides silicon, including solar inks using conventional printing press technologies, solar dyes, and conductive plastics. Some new solar cells use plastic lenses or mirrors to concentrate sunlight onto a very small piece of high efficiency PV material. The PV material is more expensive, but because so little is needed, these systems are becoming cost effective for use by utilities and industry. However, because the lenses must be pointed at the sun, the use of concentrating collectors is limited to the sunniest parts of the country.

<http://www.technologystudent.com/>

Photovoltaic cells look similar to solar panels but they work in a different way. Solar panels are used to produce hot water or even steam. Photovoltaic panels convert the sunlight directly into electricity. A typical example of a device powered by photovoltaic cells is a solar powered calculator. This type of device only needs a small amount of electrical power to work and can even be used in a room with artificial light (bulbs / fluorescent light).

Although we see photovoltaic cells powering small devices such as calculators they have a more practical application especially in the third world. Photovoltaic cells have been developed that will provide electrical power to pump drinking water from wells in remote villages. British Telecom have developed a system that can be used to power a radio telephone system. During the day the cells power the phone and also charge batteries. The batteries power the phone during the night. Often photovoltaic cells are used as a backup to conventional energy. If conventional fails the cells are used to produce electricity.

#### Wikipedia

Photovoltaics (PV) is the name of a method of converting solar energy into direct current electricity using semiconducting materials that exhibit the photovoltaic effect, a phenomenon commonly studied in physics, photochemistry and electrochemistry. A photovoltaic system employs solar panels composed of a number of solar cells to supply usable solar power. The process is both physical and chemical in nature, as the first step involves the photoelectric effect from which a second electrochemical process takes place involving crystallized atoms being ionized in a series, generating an electric current.<sup>[1]</sup>

<http://www.qrg.northwestern.edu/>

What is a solar panel?

Solar panels are devices that convert light into electricity. They are called "solar" panels because most of the time, the most powerful source of light available is the Sun, called Sol by astronomers. Some scientists call them photovoltaics which means, basically, "light-electricity."

A look at all above reveals that the description "*solar photovoltaic module and panel*" would cover the solar photovoltaic modules and panels used to generate electricity from the sun's rays and thereby, to run various applications. They are the basic ingredients on which the solar based systems stand. We have seen the impugned product. It is a road stud. Though it uses a solar panel, it would not become a "*solar photovoltaic module and panel*" *per se*. Besides we have seen above that the notification description covers not the solar based systems or applications but the "*solar photovoltaic modules and panels*" which are used to run the systems or applications. The impugned road studs can in no certain terms be termed a "*solar photovoltaic module and panel*" *per se*.



Further, the applicant has informed that the CETH's under which the impugned products are cleared as being CETH's 94055020 and 94055059. The description under Central Excise against the former is "Miner's safety lamps" and "Other" (Other of "Other oil lamps") for the latter. Though both the descriptions do not apply to the impugned product, it is seen that -

- the Heading 9405 is for "Lamps and lighting fittings including searchlights and spotlights and parts thereof, not elsewhere tariff item description of goods unit rate of duty (1) (2) (3) (4) section xx chapter 94 736 specified or included; illuminated signs, illuminated name-plates and the like, having a permanently fixed light source, and parts thereof not elsewhere specified or included"
- the sub-heading 9405 50 is for "Non-electrical lamps and lighting fittings".

Whereas it is seen that "Solar cells whether or not assembled in modules or panels" fall under the CETH 8541 40 11. It would not be necessary to discuss the classification under the Central Excise as the notification does not refer to the same. And above all, the description as notified is so very clear and plain that no external aids to interpretation need be had.

Now, the applicant has produced a letter from an official of the MEDA under the belief that the same would help confirm that the impugned item is covered by the notification description discussed in detail above - "*Solar photovoltaic modules and panels, for water pumping and other applications*". I have reproduced the contents of the said letter hereinabove. It says that the Solar Stud (solar off-grid decentralized application) comes under the Solar Photovoltaic Category. This

evidence would not be helpful as the said letter doesn't say that the impugned road stud is a "solar photovoltaic module and panel" which comprises amongst other things, a solar panel. I have reproduced the images of the road studs above, as well as images of the solar panels. Could it be even a remote possibility that if one desires to purchase a "solar photovoltaic module and panel" the impugned road stud would be offered? Certainly not. At the cost of repetition, I state that the notification description does not cover the products using the solar photovoltaic technology. It seeks to cover the solar photovoltaic modules and panels which are used for applications such as water pumping. The MEDA website also would help the applicant to understand what "*solar photovoltaic modules and panels*" are :

#### Solar Photovoltaic



Solar Power Plant

The solar electric systems work on photovoltaic principle. The heart of the system is the solar cell. The single crystal silicon solar cells convert solar energy directly to electricity. This electricity then charges the battery through a battery charger. The electrical energy thus stored in the battery is then utilized through inverter (DC to AC) or converter (DC to DC) for various purposes such as lighting, pumping and running of the TV.

A simple PV system is like any other electrical power- generating device except that the equipment used is different from that used in conventional electromechanical generating systems. The principles of operation and interfacing with other electrical systems remain the same and are guided by a well-established body of electrical codes and standards. The main systems distributed in the field are streetlights, domestic lights, water pumps, lanterns, electrical fencing, battery charger, and village lighting systems. It is always better if these systems are used without battery storage unless it is a must. As per the experience of MEDA, photovoltaic systems need maintenance occasionally. In addition, the storage battery needs to be changed time to time.

#### Benefits of Solar Photovoltaic Energy :

It operates on the freely available solar energy thus saving the expenditure on electricity and fossil fuels.

No fear of power cuts.

It is trouble free, pollution free, and noise free, has a long life and is reliable.



Easy to handle and operate.

Negligible cost of operation and maintenance.

Objective of MEDA Programme

To promote the use of Solar Photovoltaic (SPV) Systems such as SPV home light systems, SPV street light systems, small capacity SPV power plants, solar generators, building integrated Photovoltaic (BIVP) Systems and solar lanterns.

To reduce the consumption of kerosene for lighting purposes by replacing the lanterns and wick lamps with SPV systems.

To improve the quality of life in rural areas through use of environment- friendly solar lighting systems which do not need any fossil fuels or emit any pollutants and are free from health and fire hazards.

To provide an alternative to the conventional grid electrification for meeting rural energy requirements.

Apart from the above, I have come across a document of the Karnataka State Highways

Improvement Project – II, Stage 1 Bid Documents which states thus :

B2.7.8 CLAUSE 814 SOLAR ROAD STUDS

B2.7.8.1 GENERAL :

**Solar Powered Road Stud is an active Road Safety Device, which is anchored to the road surface for marking and delineation for night time visibility. It is a self contained device with a Solar Module, Battery, LED & electronics, designed to switch – ON automatically at Dusk and flash throughout the night to provide adequate visibility and advance warning to the motorist while driving on the roads. Unlike passive reflector type road studs, effectiveness of Solar Road stud does not depend on the luminous intensity and reach of vehicle head light, but, works on free Solar energy to operate LEDs that flash throughout the night, providing long range visibility, guidance and advance warning to road users, thus improving driving safety on roads.**

B2.7.8.2 DEFINITIONS :

LED : Light Emitting Diode.

**SOLAR MODULE : Semiconductor device that converts Light energy into electrical energy.**

Ni-MH : Nickel Metal Hydride battery (Energy storage device)

DUSK TO DAWN OPERATION : Switch ON at evening (OR when sunlight goes away ) and OFF in the morning (OR when Sunlight is available).

MEMORY EFFECT: Property of some type of Batteries ( say, Ni-Cd ) to lose their capacity for full recharging, if they are discharged repeatedly the same amount and then recharged without overcharge before they have fully drained. The term derives from the fact that the battery appears to have a memory for the amount of charging it can sustain.

HEAD: Part of the stud which is above the road surface when road stud is fixed in position on the road.

ANCHORAGE: Part of the road stud, which is below the road surface when the road stud is fixed in position on the road.

B2.7.8.3 MATERIAL :

BODY: Body of the Solar Road Studs should be made of Aluminium Die Cast, Capable of taking compression load of 175 KN

TOP COVER : Top cover over the PV Module should be made of clear, Transparent, anti-static Poly Carbonate material of minimum 4.5 mm thickness

PV MODULE : Solar PV Module should be made of high efficiency Crystalline Silicon PV cells of conversion efficiency not less than 13%.

BATTERY : Storage battery should be of Ni-MH type only, to avoid memory effect and provide long life. Cycle life should be greater than 350 Cycle @ 100 % DOD (Depth of discharge). The minimum capacity of the battery should be 2000 mAh. Battery should be supplied in detached condition and should be fixed just before installation of the studs.

LED: Ultra Bright LEDs of minimum 5 mm Dia having luminous intensity > 2000 mcd (with 23° Viewing angle) be used. All LEDs should be covered with Poly Carbonate covers on the sides. Minimum three (3) LEDs should be on one tapering side for Uni-Directional Solar Studs and on two opposite tapering sides of Bi-Directional Solar Studs.

REFLECTOR: High intensity reflective grade polymer sticker with back adhesive for additional passive reflection of headlight be fixed around the LED area.

B2.7.8.4 DESIGN :

BODY CASING : Matte Finish (Sand Blasted) Aluminium Die cast body casing with AntiTwist ribs for additional grip and resist twisting. Body top should have embossed raised surface to prevent vehicle load falling on the central Poly Carbonate Cover over the PV module. Water draining channels to be provided on top casing.

BATTERY CAP : Battery casing should have removable cap for installation of Ni-MH battery, to prevent self-discharge during storage.

PROTECTION : Solar Road Stud should have IP 65 protection for water tightness.

HEAD : Shall be of square shape with rounded edges.

ANCHORAGE : Min. depth 50mm and dia minimum 33mm. Should have min.6 Nos. external anti-twist ribs.

OPERATING TEMPERATURE : - 20°C to + 55° C

VISIBILITY : >500 Meters at clear night conditions (Straight Line)

DIMENSION : Not less than 122x132x75 mm

WEIGHT : Not less than 650 gms.

OPERATION : Automatic Dusk to Dawn Solar Switching.

AUTONOMY : Battery back-up should be for minimum three(3) No-Sun days.

FLASHING RATE : Typically 1 Hz.

COMPRESSION CAPACITY : Minimum 175 KN

GRADIENT ON LED SIDES : 30 degree

.....  
Thus, the above document recognizes a solar road stud as a road safety device which works with the help of the solar module and the other ingredients.



I have come across yet another document dt.03.03.2010 of the National Highways Authority of India (NAI) on the subject of "Specifications for Reflective Pavement Markers (Road Studs)". It states that the device reflects incident light in directions close to the direction from which it came. These are made of a plastic body. The reflective panels consist of lenses containing single or dual prismatic cubes and the lenses are made of methyl methacrylate. Thus, these devices work on the reflective principle whereas the impugned road studs use the solar principle. As dealt with in the earlier part of this order, the NHAI and Karnataka State Highways Improvement documents reveal that road studs work on different principles and are of various types. Therefore the MEDA certification to the applicant that the road stud comes under the Solar Photovoltaic Category should not be taken to mean that the impugned product is "solar photovoltaic module and panel" per se. And we have seen above that the impugned description of the notification covers not the devices but the technology namely "solar photovoltaic modules and panels". The schedule entry A-56 or C-82 cover only those products as are notified. Therefore, no evidence other than the interpretation of the impugned description would be of any help. I summarize the discussion thus :

1. The description notified is "Solar photovoltaic modules and panels, for water pumping and other applications".
2. The description covers "Solar photovoltaic modules and panels" and not water pumping and other applications which use "Solar photovoltaic modules and panels".
3. The description does not cover applications but it covers the "Solar photovoltaic modules and panels" only.
4. The impugned product is a device using "Solar panels" and is not "solar panel" per se.
5. If one requires a "Solar photovoltaic module and panel", one would not purchase a road stud.
6. The impugned product has a distinct identity as a "road stud"

The impugned road studs do not fit the description as notified at sr. no.10 for the purposes of the schedule entry C-82 (upto June 2009) and schedule entry A-56 (from July 2009 onwards). Further, it is also seen that there is no specific schedule entry for the impugned road studs. In view thereof, the products find placed in the residuary schedule entry E-1 of the MVAT Act,2002, thereby liable to tax @12.5%.

05. In view of the elaborate deliberations as held hereinabove, it is determined thus -

### **ORDER**

(under section 56(1)(e) of the Maharashtra Value Added Tax Act, 2002)

No.DDQ-11-2014/Adm-6/8/B- 1

Mumbai, dt. 4/5/2016

For reasons as discussed in the body of the order, it is herewith determined that -





- *The Solar Road Studs (Solar Power Pavement Edge warning Light/Solar Warning Lights or Warning Blinder) are not covered by the description "Solar photovoltaic modules and panels, for water pumping and other applications".*
- *In absence of a specific schedule entry under the Maharashtra Value Added Tax Act, 2002 for the impugned road studs, the products find placed in the residuary schedule entry E-1 of the MVAT Act,2002, thereby liable to tax @12.5%.*



(RAJIV JALOTA)

COMMISSIONER OF SALES TAX,  
MAHARASHTRA STATE, MUMBAI