# Tetris Energy Pty Ltd

## Tetris Energy Solar Farms Land: 101 Coombs Road, Mangalore, Victoria

## Noise Impact Report

AC01

AC01 V4 | 19 February 2021





This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 278118

Arup Australia Pty Ltd ABN 76 625 912 665

**Arup**
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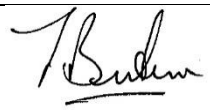
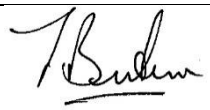
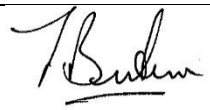
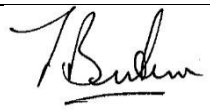
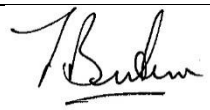
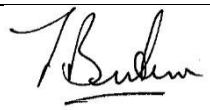
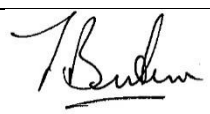
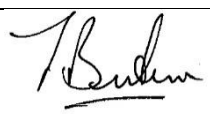
Docklands Vic 3008
Australia
www.arup.com

ARUP

# Document verification

ARUP

| | | | | | |
|---|---|---|---|---|---|
| **Job title** | | Tetris Energy Solar Farms<br>Land: 101 Coombs Road, Mangalore, Victoria | | **Job number** | 278118 |
| **Document title** | | Noise Impact Report | | **File reference** | |
| **Document ref** | | AC01 | | | |
| **Revision** | **Date** | **Filename** | AC01 v1 101 Coombs Road Solar Acoustic Report.docx | | |
| Final | 30 Oct 2020 | **Description** | Issue | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | Nick Wedd | Frank Butera | Frank Butera |
| | | Signature |  |  |  |
| V2 | 20 Nov 2020 | **Filename** | AC01 v2 101 Coombs Road Solar Acoustic Report.docx | | |
| | | **Description** | Clarifying site location. | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | Nick Wedd | Frank Butera | Frank Butera |
| | | Signature |  |  |  |
| V3 | 9 Dec 2020 | **Filename** | AC01 v3 101 Coombs Road Solar Acoustic Report.docx | | |
| | | **Description** | Updating table heading. | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | Nick Wedd | Frank Butera | Frank Butera |
| | | Signature |  |  |  |
| V4 | 19 Feb 2021 | **Filename** | AC01 v4 101 Coombs Road Solar Acoustic Report.docx | | |
| | | **Description** | Updated project layout plan. | | |
| | | | Prepared by | Checked by | Approved by |
| | | Name | Nick Wedd | Frank Butera | Frank Butera |
| | | Signature |  |  |  |
| | | | | **Issue Document verification with document** | ✓ |

# Contents



## Appendices

# 1 Introduction

Energy Forms Pty Ltd (Energy Forms) are seeking planning permit approval on behalf of Tetris Energy Pty Ltd for the operation of a 10 MW Solar Farm located at 101 Coombs Road, Mangalore (the Subject Site) approximately 3km east of the Goulbourn Valley Freeway.

Arup Australia Pty Ltd (Arup) has been instructed by Energy Forms to prepare a noise impact report as requested by the Responsible Authority to meet the requirements of the Planning Permit. Arup has considered the following documents:

- *Solar Energy Facilities Design and Development Guideline*.
- Noise levels emanating from the premises must comply with *Noise from Industry in Regional Victoria* Publication 1411 (NIRV).

A desktop assessment of the noise impacts from the proposed development to nearest noise sensitive receivers has been conducted. This assessment has been based on manufacturer's noise levels, Arup's noise database, and noise calculations and predictions.

Acoustic terminology used throughout this report is provided in Appendix A.

# 2 Site Description

## 2.1 Site Surroundings

The Subject Site forms part of the land addressed as 101 Coombs Road, Mangalore which consists land parcel 18A\PP3053. It covers approximately 128 hectares and is bound by private property to the north, Station Road to the East, Seymour-Avenel Road to the south, and private property to the west. A site plan of the proposed facility is presented in Appendix B.

The Subject Site is zoned Farming Zone (FZ) and is bound by the following:

- **To the North** – Farming Zone (FZ) with additional Farming Zone (FZ) located further to the north. The nearest identified residential property is located approximately 2 km from the Subject Site at 57 Station Road, Mangalore.
- **To the East** – Farming Zone (FZ) and Seymour-Avenel Road. The nearest identified residential property is located approximately 700 m from the Subject Site at 984 Seymour-Avenel Road, Mangalore.
- **To the South** – Farming Zone (FZ). The nearest identified residential property is located approximately 600 m from the Subject Site.
- **To the West** – Farming Zone (FZ), further Farming Zone (FZ) extends west. The nearest residential property in this direction is approximately 1.8k from the Subject Site.

A planning map of the area surrounding the Subject Site is presented in Appendix C.

The nearest residential receivers are located to the east and south. The layout of the site and the location nearby noise-sensitive receivers are shown in Figure 1.

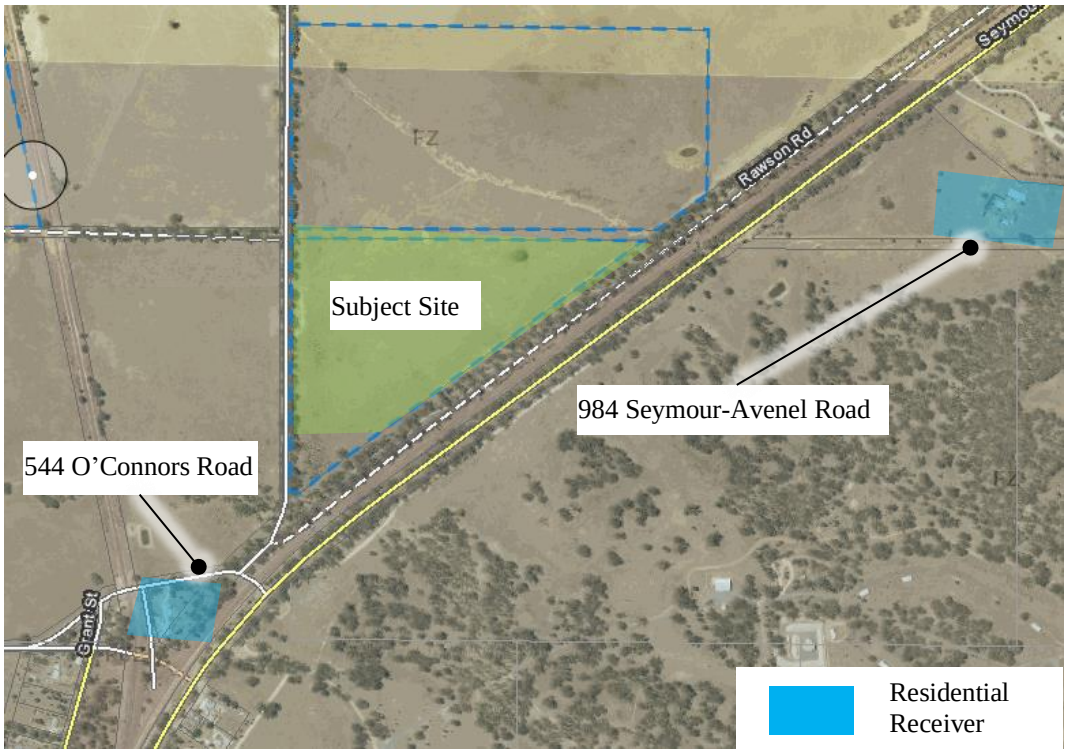



Figure 1: Location of subject site and surrounding noise-sensitive residential receivers.

## 2.2 Site Description

A 10 MW solar farm is proposed to be installed at the Subject Site. Equipment specification for the plant is presented in Appendix D. The Subject Site is approximately 12.8 ha (128,000 m²).

The solar farm consists of:

- Approximately 250 tracking PV panels.
- 4 x 2.5 MV A combined inverter and transformer units.
- 5 x Battery Storage Stations.
- Various cabling to supply electricity to the grid.

## 2.3 Operations

The Subject Site is proposed to operate both during and after sunlight hours, due to the battery storage. Noise will be assessed for the most sensitive night-time period.

# 3 Noise Criteria

The relevant noise criteria includes:

- *Solar Energy Facilities Design and Development Guideline*.
- Noise levels emanating from the premises must comply with *Noise from Industry in Regional Victoria* Publication 1411(NIRV).

The *Solar Energy Facilities Design and Development Guideline* states that "A facility should keep its noise impacts at or below the levels in EPA Victoria's *Noise from Industry in Regional Victoria guideline (NIRV).* As such, the noise emissions will be assessed against NIRV noise limits.

## 3.1 Industry in Regional Victoria

*Industry in Regional Victoria* (NIRV) Publication 1411, dated October 2011 provides guidelines to set noise levels for industry in regional Victoria. For the purposes of the NIRV, areas outside the SEPP N-1 area of application are categorised as either 'major urban' or 'rural' areas. A rural area is defined as:

- Land in cities or towns with population below 7000; or
- Rural locations outside major urban areas.

The Subject Site is in a rural area, outside the major urban area of Melbourne and there are no SEPP N-1 boundaries in the vicinity of the Subject Site. As a result, the Subject Site falls outside the SEPP N-1 boundary and noise limits shall be set in accordance with the NIRV.

The NIRV guidelines are non-statutory. However, in the absence of specific legislative noise requirements, the subject site has been assessed in accordance with the NIRV.

The noise limits defined in the NIRV are based on the time periods detailed in State Environment Protection *Policy (Control of Noise from Commerce, Industry and Trade) No. N-1* (SEPP N-1) and are presented in Table 1.

Table 1: Time periods for SEPP N-1 and NIRV assessment

| Period | Day of week | Time period |
|---|---|---|
| Day | Monday – Friday | 07:00 – 18:00 hrs |
| | Saturday | 07:00 – 13:00 hrs |
| Evening | Monday – Friday | 18:00 – 22:00 hrs |
| | Saturday | 13:00 – 22:00 hrs |
| | Sunday, Public Holidays | 07:00 – 22:00 hrs |
| Night | Monday – Sunday | 22:00 – 07:00 hrs |

The assessment of noise emissions under the NIRV is based on the calculation of a noise limit at the receiver position, taking into account the land use in the surrounding area and the ambient noise level.

The NIRV noise limit is defined in Table 1 of the NIRV. The noise limit may be adjusted appropriately depending on the background noise level and propagation distance between the noise source and the noise sensitive receiver.

The first step in the NIRV is to determine the zoning levels of the Subject Site and the surrounding noise sensitive receivers. The following zone has been identified:

- Farming Zone (FZ)

The land is not required to be re-zoned as part of the planning process, with the majority of solar farms in Victoria being located on Farming Zoned land.

The NIRV noise limits are presented in Table 2.

Table 2: NIRV noise limits for dwellings on land located in Farming Zone, dB(A)

| **SEPP N-1/NIRV Assessment Period** | **Farming Zone** |
|---|---|
| Day | 46 |
| Evening | 41 |
| Night | 36 |

These limits form the basis for assessing the impact of industrial noise to noise sensitive receivers in the vicinity of the Subject Site. The Planning Zone Map for the Subject Site is provided in Appendix C.

Demonstrating compliance with the noise limits at the closest receivers during the night-time period demonstrates compliance with other receivers, for other time-periods.

# 4 Noise Assessment

The following noise sources have been assessed:

- Noise from the combined transformer and inverter units (Sunny Central 2500-EV inverter/transformer).
- Battery storage system (SMA 4.5 MWh Energy Storage Station).
- Tracking solar panel motors (NEXTracker motor).

Noise data was obtained from the manufacturer and supplemented by noise data from Arup's database. Appendix D presents the specification from the equipment suppliers.

The noise spectrum from Arup's database levels of transformers/inverters has been adjusted match the broadband noise level for the proposed equipment. The noise levels for the equipment are provided in Table 3.

Table 3: Noise levels of proposed solar farm plant.

| **Equipment** | **Leq dB(A)** | **Measured Sound Power Level, dB re 1 pW Octave Band Centre Frequency, Hz** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k |
| Combined 2.5 MW inverter and transformer | 92 | 86 | 90 | 96 | 89 | 85 | 81 | 73 |
| Battery Storage System | 86 | 91 | 93 | 88 | 83 | 80 | 75 | 68 |
| Solar Panel tracking motor | 57 | 44 | 47 | 49 | 52 | 52 | 51 | 46 |

## 4.1 Noise to nearest affected residential properties

Operational noise to the nearest affected residential properties has been considered in accordance with NIRV criteria. A 2 dB(A) penalty has been applied to account for any tonality present in the noise from the operation of the generator/inverter.

Distance propagation formulae and atmospheric attenuation (as per ISO 9613.2[1]) have been applied to predict noise levels at the nearest impacted residential properties. Noise from all operating equipment (listed in Table 3) has been considered.

Table 4 presents the predicted noise levels at the nearest affected residential receivers for the night-time period. Compliance during the most stringent night-time period demonstrates compliance during the day and evening periods while operating at full-capacity. Based on the Arup's assessment the solar farm is expected to be continuously compliant with the NIRV noise limits.

[1] ISO 6613.2 *Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation.*

Table 4: Predicted noise levels at residential receivers.

| **Location** | **Noise limit - Night, Leq dB(A)** | **Predicted noise level - Night, $L_{eq}$ dB(A)** | **Complies?** |
|---|---|---|---|
| 544 Oconnors Road | 36 | 35 | ✓ |
| 984 Seymour-Avenel Road | 36 | 32 | ✓ |

Arup's assessment demonstrates that operational noise from the Subject Site complies with the NIRV noise limits at the nearest affected residential properties.

# 5 Summary

Arup has completed a noise assessment to understand the current noise environment and establish noise limits for noise emitted from the subject site. Noise limits have been determined through the following documents:

- *Solar Energy Facilities Design and Development Guideline*.
- Noise levels emanating from the premises must comply with *Noise from Industry in Regional Victoria* Publication 1411 (NIRV).

Noise levels from Arup's database and noise levels supplied by the manufacturer have been used to predict compliance of noise limits.

The proposed plant is predicted to comply with NIRV noise limits when operating at full capacity.

The proposed operation of the solar farm at the Subject Site is expected to continuously comply with noise limits associated with the Planning Permit approval process.

# Appendix A

Acoustic Glossary

## Ambient Noise Level

The ambient noise level is the overall noise level measured at a location from multiple noise sources. When assessing noise from a particular development, the ambient noise level is defined as the remaining noise level in the absence of the specific noise source being investigated. For example, if a fan located on a city building is being investigated, the ambient noise level is the noise level from all other sources without the fan running. This would include sources such as traffic, birds, people talking and other nearby fans on other buildings.

## Background Noise Level

The background noise level is the noise level that is generally present at a location at all or most times. Although the background noise may change over the course of a day, over shorter time periods (e.g. 15 minutes) the background noise is almost-constant. Examples of background noise sources include steady traffic (e.g. motorways or arterial roads), constant mechanical or electrical plant and some natural noise sources such as wind, foliage, water and insects.

## Decibel

The decibel scale is a logarithmic scale which is used to measure sound and vibration levels. Human hearing is not linear and involves hearing over a large range of sound pressure levels, which would be unwieldy if presented on a linear scale. Therefore a logarithmic scale, the decibel (dB) scale, is used to describe sound levels.

An increase of approximately 10 dB corresponds to a subjective doubling of the loudness of a noise. The minimum increase or decrease in noise level that can be noticed is typically 2 to 3 dB.

## dB(A)

dB(A) denotes a single-number sound pressure level that includes a frequency weighting (“A-weighting”) to reflect the subjective loudness of the sound level.

The frequency of a sound affects its perceived loudness. Human hearing is less sensitive at low and very high frequencies, and so the A-weighting is used to account for this effect. An A-weighted decibel level is written as dB(A).

Some typical dB(A) levels are shown below.

| Sound Pressure Level dB(A) | Example |
|---|---|
| 130 | Human threshold of pain |
| 120 | Jet aircraft take-off at 100 m |
| 110 | Chain saw at 1 m |
| 100 | Inside nightclub |

| Sound Pressure Level dB(A) | Example |
|---|---|
| 90 | Heavy trucks at 5 m |
| 80 | Kerbside of busy street |
| 70 | Loud stereo in living room |
| 60 | Office or restaurant with people present |
| 50 | Domestic fan heater at 1m |
| 40 | Living room (without TV, stereo, etc) |
| 30 | Background noise in a theatre |
| 20 | Remote rural area on still night |
| 10 | Acoustic laboratory test chamber |
| 0 | Threshold of hearing |

### $L_{90}$

The $L_{90}$ statistical level is often used as the "average minimum" or "background" level of a sound level that varies with time.

Mathematically, $L_{90}$ is the sound level exceeded for 90% of the measurement duration. As an example, 45 dB $L_{A90,15min}$ is a sound level of 45 dB(A) or higher for 90% of the 15 minute measurement period.

### $L_{eq}$

The 'equivalent continuous sound level', $L_{eq}$, is used to describe the level of a time-varying sound or vibration measurement.

$L_{eq}$ is often used as the "average" level for a measurement where the level is fluctuating over time. Mathematically, it is the energy-average level over a period of time (i.e. the constant sound level that contains the same sound energy as the measured level). When the dB(A) weighting is applied, the level is denoted dB $L_{Aeq.}$ Often the measurement duration is quoted, thus $L_{Aeq,15\ min}$ represents the dB(A) weighted energy-average level of a 15 minute measurement.

## Frequency

Frequency is the number of cycles per second of a sound or vibration wave. In musical terms, frequency is described as "pitch". Sounds towards the lower end of the human hearing frequency range are perceived as "bass" or "low-pitched" and sounds with a higher frequency are perceived as "treble" or "high pitched".

## Sound Power and Sound Pressure

The sound power level ($L_w$) of a source is a measure of the total acoustic power radiated by a source. The sound pressure level ($L_p$) varies as a function of distance from a source. However, the sound power level is an intrinsic characteristic of a

source (analogous to its mass), which is not affected by the environment within which the source is located.

# Appendix B

Site Plan


TETRIS ENERGY

PCC &ASSOCIATES

## GENERAL NOTES:

1. EQUIPMENT LAYOUT AND SITE BOUNDARY BASED ON THE PROVIDED INFORMATION AND SATELLITE IMAGE NOT ACTUAL SURVEY DATA
2. FOR PRELIMINARY DESIGN ONLY. ACTUAL DETAIL TO BE FINALISED DURING DETAILED DESIGN
3. TRACKER DIMENSION IS ESTIMATED ONLY
4. DIMENSION SHOWN FOR MVPS, SWITCHGEAR, AND BESS ARE INDICATIVE. THIS IS SUBJECT TO FINALI SELECTION OF THE TECHNOLOGIES AND THEIR INSTALLATION REQUIREMENT

## PROJECT SPECIFICATIONS

| | | |
|---|---|---|
| AC CAPACITY AT POINT OF CONNECTION | TBC | MW ac |
| INSTALLED AC CAPACITY | 4.60 | MW ac |
| DC CAPACITY AT STC | 6.13 | MW dc |
| DC:AC RATIO | 1.31 | |
| TRACKER CONFIGURATION | 1P | |
| 3-STRING TRACKER DIMENSIONS (78-MODULE) | 100 x 2.31 | m |
| 2-STRING TRACKER DIMENSIONS (52 MODULE) | 68 x 2.31 | m |
| 1-STRING TRACKER DIMENSIONS (26 MODULE) | 40 x 2.31 | m |
| TRACKER PITCH | 5 | m |
| TRACKER AZIMUTH | 0 | ° |
| INVERTER CAPACITY | 4.60 | MVA |
| MODULE TYPE | Mono PERC Bi-Facial | |
| MODULE POWER | 530 | W |
| MODULES PER STRING | 28 | |
| MODULES PER TRACKER | 28/ 56 / 84 | |
| TOTAL INVERTERS | 1 | |
| TOTAL TRACKERS (84 MODULE) | 112 | |
| TOTAL TRACKERS (56 MODULE) | 8 | |
| TOATAL TRACKER (28 MODULE) | 61 | |
| TOTAL MODULES | 11.564 | |
| SITE AREA | 9.0 | Ha |
| SITE PERIMETER | 1,378 | m |

## LEGEND:

- GATE
- ACCESS ROAD
- MVPS AREA
- INVERTER
- POINT OF CONNECTION
- PROPOSED FENCE
- OH POWERLINE
- OH POWERLINE EASEMENT
- CADASTRAL BOUNDARY
- 3-STRING TRACKERS
- 2-STRING TRACKERS
- 1-STRING TRACKERS

| REV: | DESCRIPTION: | BY: | DATE: |
|---|---|---|---|
| E | PRELIMINARY DESIGN | PC | 4/02/21 |

STATUS: CONCEPT DESIGN
NOT FOR CONSTRUCTION

CLIENT: TETRIS ENERGY

DESIGNER: PCC & ASSOCIATES

SITE: MANGALORE SOLAR FARM
MANGALORE VIC 3663

TITLE: OVERALL SITE LAYOUT

| SCALE AT A1: | DATE: | DRAWN: | AUTHORISED: |
|---|---|---|---|
| 1:1250m | 4/02/21 | PC | PC |

| PROJECT NO: | DRAWING NO: | REVISION: |
|---|---|---|
| P20-0011 | P20-0011-01 | E |

# Appendix C

Planning Map

# PLANNING PROPERTY REPORT

Environment, Land, Water and Planning

From www.planning.vic.gov.au at 09 October 2020 10:18 AM

## PROPERTY DETAILS

| | |
|---|---|
| Address: | **299 OCONNORS ROAD MANGALORE 3663** |
| Crown Description: | **More than one parcel - see link below** |
| Standard Parcel Identifier (SPI): | **More than one parcel - see link below** |
| Local Government Area (Council): | **STRATHBOGIE** www.strathbogie.vic.gov.au |
| Council Property Number: | **51051128.0000** |
| Planning Scheme: | **Strathbogie** Planning Scheme - Strathbogie |
| Directory Reference: | **Vicroads 46 D8** |

This property has 15 parcels. For full parcel details get the free Property report at Property Reports

## UTILITIES

| | |
|---|---|
| Rural Water Corporation: | **Goulburn-Murray Water** |
| Urban Water Corporation: | **Goulburn Valley Water** |
| Melbourne Water: | **Outside drainage boundary** |
| Power Distributor: | **AUSNET** |

View location in VicPlan

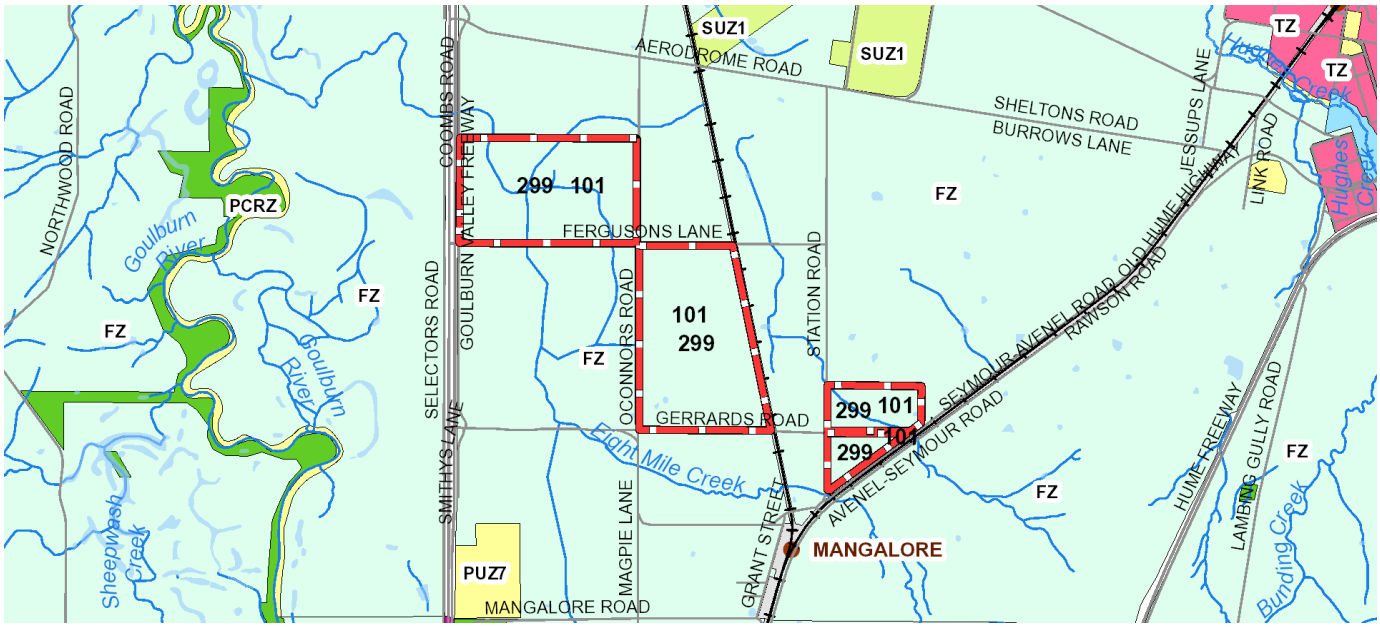
## STATE ELECTORATES

| | |
|---|---|
| Legislative Council: | **NORTHERN VICTORIA** |
| Legislative Assembly: | **EUROA** |

## Planning Zones

FARMING ZONE (FZ)

SCHEDULE TO THE FARMING ZONE (FZ)



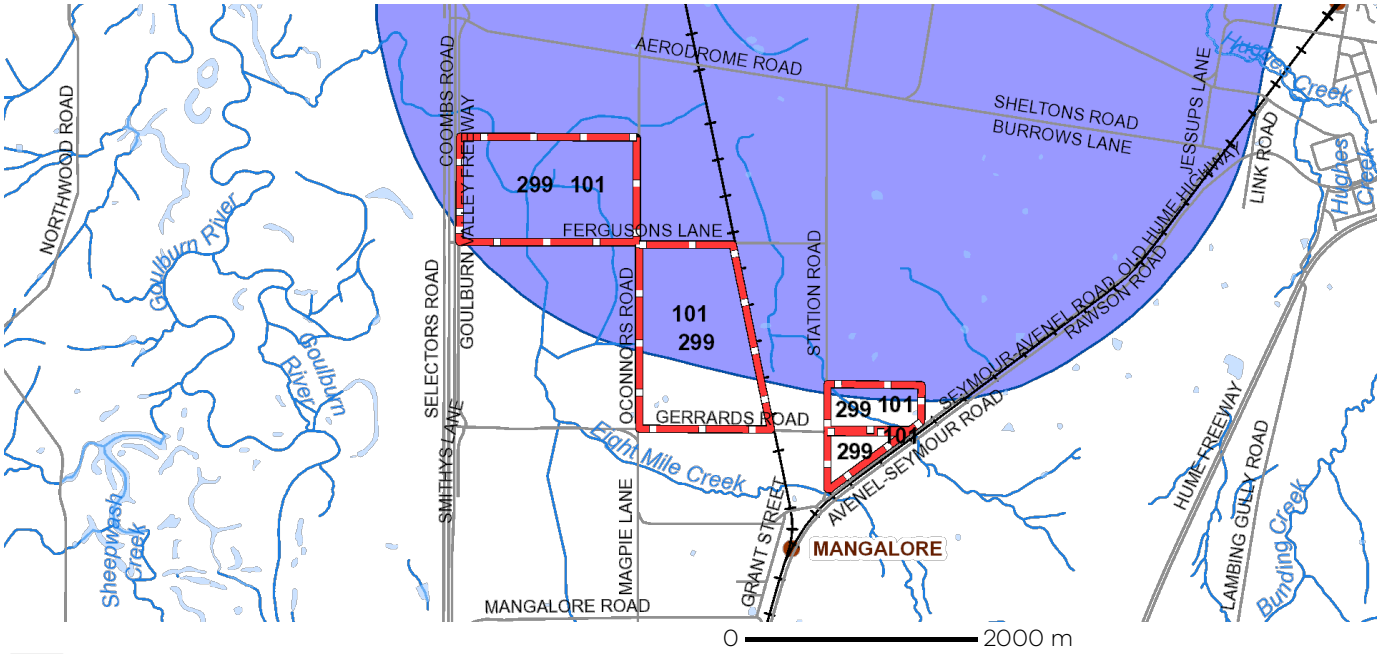

Note: labels for zones may appear outside the actual zone - please compare the labels with the legend.

# PLANNING PROPERTY REPORT

## Planning Overlays

AIRPORT ENVIRONS OVERLAY (AEO)

AIRPORT ENVIRONS OVERLAY (AEO2) SCHEDULE



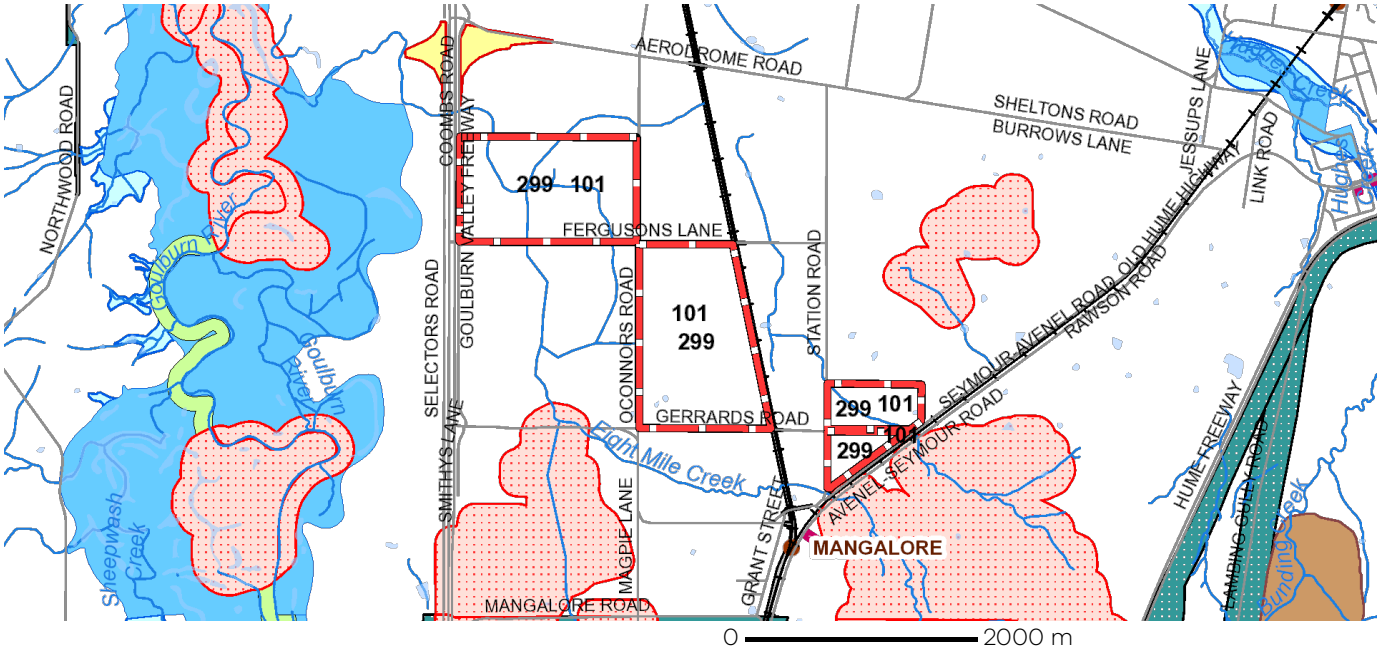

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend

# PLANNING PROPERTY REPORT

OTHER OVERLAYS

Other overlays in the vicinity not directly affecting this land

BUSHFIRE MANAGEMENT OVERLAY (BMO)
ENVIRONMENTAL SIGNIFICANCE OVERLAY (ESO)
EROSION MANAGEMENT OVERLAY (EMO)
FLOODWAY OVERLAY (FO)
HERITAGE OVERLAY (HO)
LAND SUBJECT TO INUNDATION OVERLAY (LSIO)
PUBLIC ACQUISITION OVERLAY (PAO)
SPECIFIC CONTROLS OVERLAY (SCO)
VEGETATION PROTECTION OVERLAY (VPO)




BMO - Bushfire Management
ESO - Environmental Significance
EMO - Erosion Management
FO - Floodway
HO - Heritage
LSIO - Land Subject to Inundation
PAO - Public Acquisition
SCO - Specific Controls
VPO - Vegetation Protection
Railway line
Railway station
Water area
Water course

Note: due to overlaps, some overlays may not be visible, and some colours may not match those in the legend

# PLANNING PROPERTY REPORT

## Areas of Aboriginal Cultural Heritage Sensitivity

All or part of this property is an 'area of cultural heritage sensitivity'.

'Areas of cultural heritage sensitivity' are defined under the Aboriginal Heritage Regulations 2018, and include registered Aboriginal cultural heritage places and land form types that are generally regarded as more likely to contain Aboriginal cultural heritage.

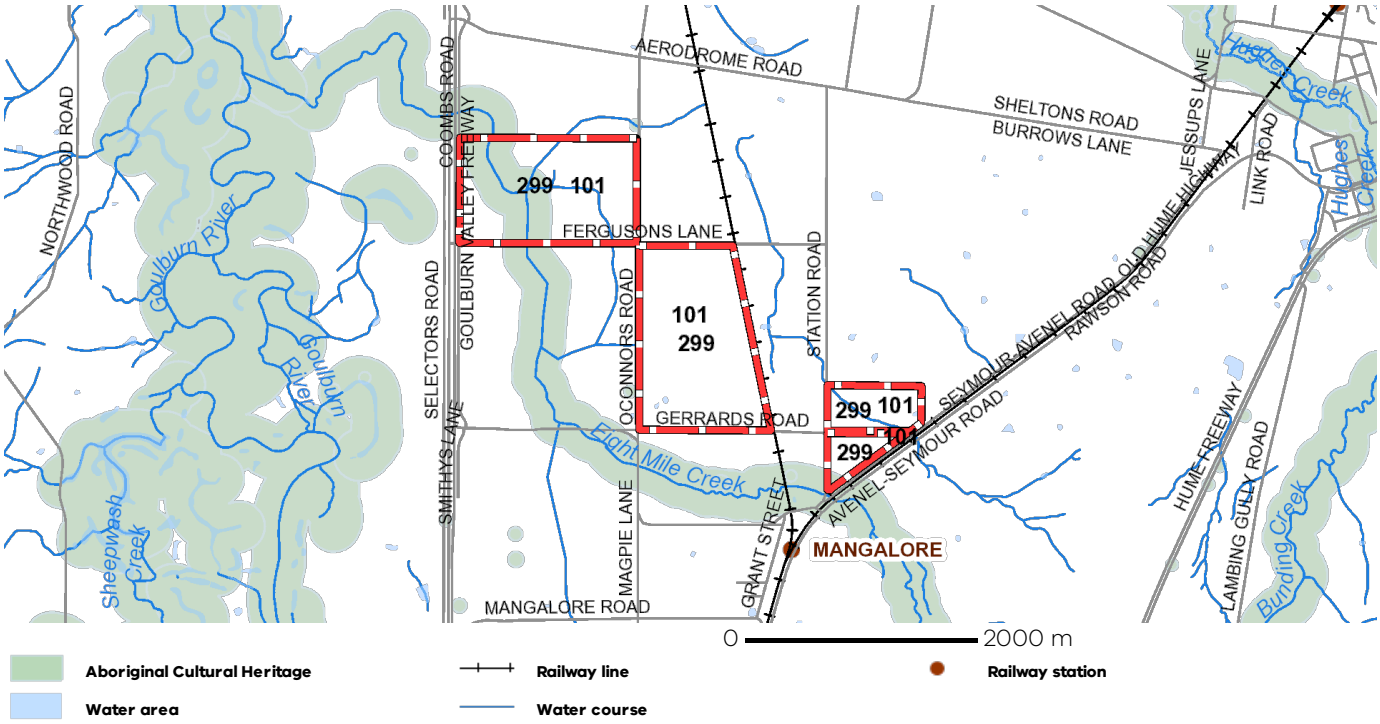
Under the Aboriginal Heritage Regulations 2018, 'areas of cultural heritage sensitivity' are one part of a two part trigger which require a 'cultural heritage management plan' be prepared where a listed 'high impact activity' is proposed.

If a significant land use change is proposed (for example, a subdivision into 3 or more lots), a cultural heritage management plan may be triggered. One or two dwellings, works ancillary to a dwelling, services to a dwelling, alteration of buildings and minor works are examples of works exempt from this requirement.

Under the Aboriginal Heritage Act 2006, where a cultural heritage management plan is required, planning permits, licences and work authorities cannot be issued unless the cultural heritage management plan has been approved for the activity.

For further information about whether a Cultural Heritage Management Plan is required go to http://www.aav.nrms.net.au/aavQuestion1.aspx

More information, including links to both the Aboriginal Heritage Act 2006 and the Aboriginal Heritage Regulations 2018, can also be found here - https://www.aboriginalvictoria.vic.gov.au/aboriginal-heritage-legislation



# PLANNING PROPERTY REPORT

## Further Planning Information

Planning scheme data last updated on 1 July 2020.

A **planning scheme** sets out policies and requirements for the use, development and protection of land.
This report provides information about the zone and overlay provisions that apply to the selected land.
Information about the State and local policy, particular, general and operational provisions of the local planning scheme that may affect the use of this land can be obtained by contacting the local council or by visiting https://www.planning.vic.gov.au

This report is NOT a **Planning Certificate** issued pursuant to Section 199 of the ***Planning and Environment Act 1987.***
It does not include information about exhibited planning scheme amendments, or zonings that may abut the land.
To obtain a Planning Certificate go to Titles and Property Certificates at Landata - https://www.landata.vic.gov.au

For details of surrounding properties, use this service to get the Reports for properties of interest.

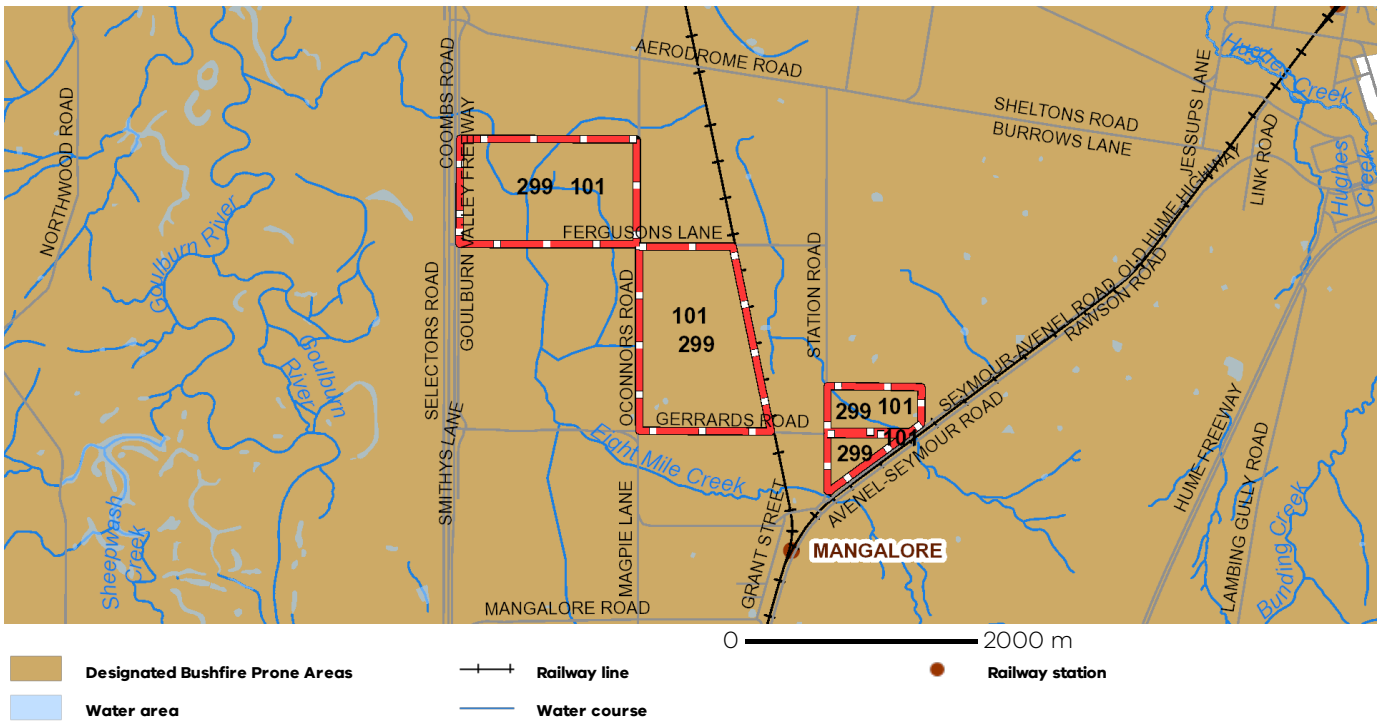
To view planning zones, overlay and heritage information in an interactive format visit https://mapshare.maps.vic.gov.au/vicplan

For other information about planning in Victoria visit https://www.planning.vic.gov.au

# PLANNING PROPERTY REPORT

## Designated Bushfire Prone Areas

**This property is in a designated bushfire prone area.**
**Special bushfire construction requirements apply. Planning provisions may apply.**




Designated bushfire prone areas as determined by the Minister for Planning are in effect from 8 September 2011 and amended from time to time.

The Building Regulations 2018 through application of the Building Code of Australia, apply bushfire protection standards for building works in designated bushfire prone areas.

Designated bushfire prone areas maps can be viewed on VicPlan at https://mapshare.maps.vic.gov.au/vicplan or at the relevant local council.

Note: prior to 8 September 2011, the whole of Victoria was designated as bushfire prone area for the purposes of the building control system.

Further information about the building control system and building in bushfire prone areas can be found on the Victorian Building Authority website https://www.vba.vic.gov.au

Copies of the Building Act and Building Regulations are available from http://www.legislation.vic.gov.au

For Planning Scheme Provisions in bushfire areas visit https://www.planning.vic.gov.au

# Appendix D

Manufacturer Data

# SMA ENERGY STORAGE STATION


ESS-AC-Energy / ESS-AC-Medium / ESS-AC-Power / ESS-DC-Energy / ESS-DC-Medium

Similar to figure

### All in one

- Integration of all components
- Support from design to Site Acceptance Test

### Ease of use

- Fully tested and harmonized components
- Simple plug-and-play design
- Modular design for easy extension

### Flexibility

- AC-coupled and DC-coupled options available
- Suitable for Micro Grid and Grid connected applications
- Wide range of batteries for power and energy applications

### Safety & Reliability

- Designed for harsh environments
- Advanced fire detection system
- Highly efficient thermal management
- Comprehensive monitoring from system to cell level

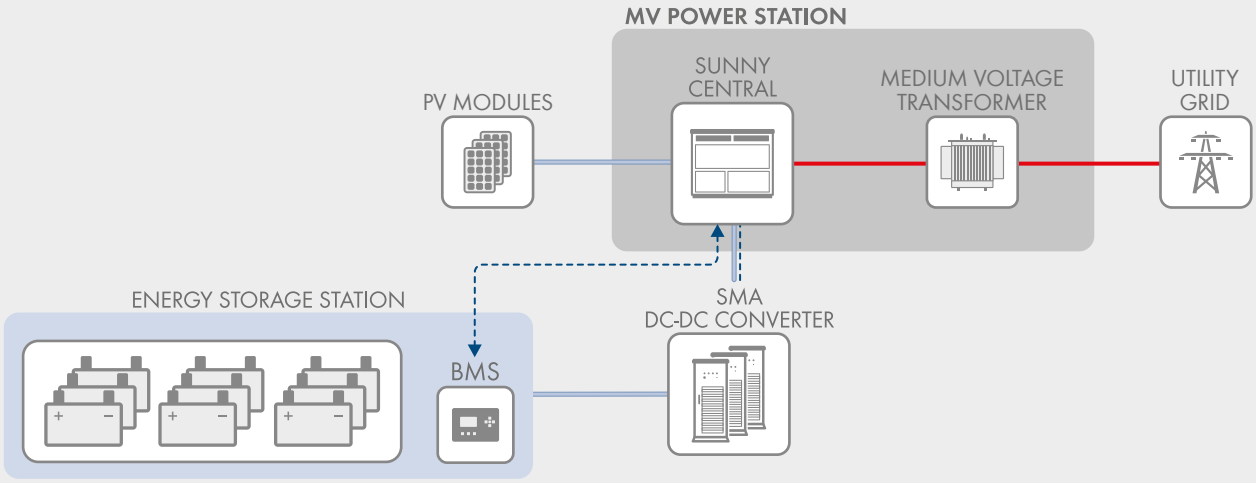
## SMA ENERGY STORAGE STATION "SMA ESS"

Plug-and-play storage solution enabling 100% renewable electricity supply

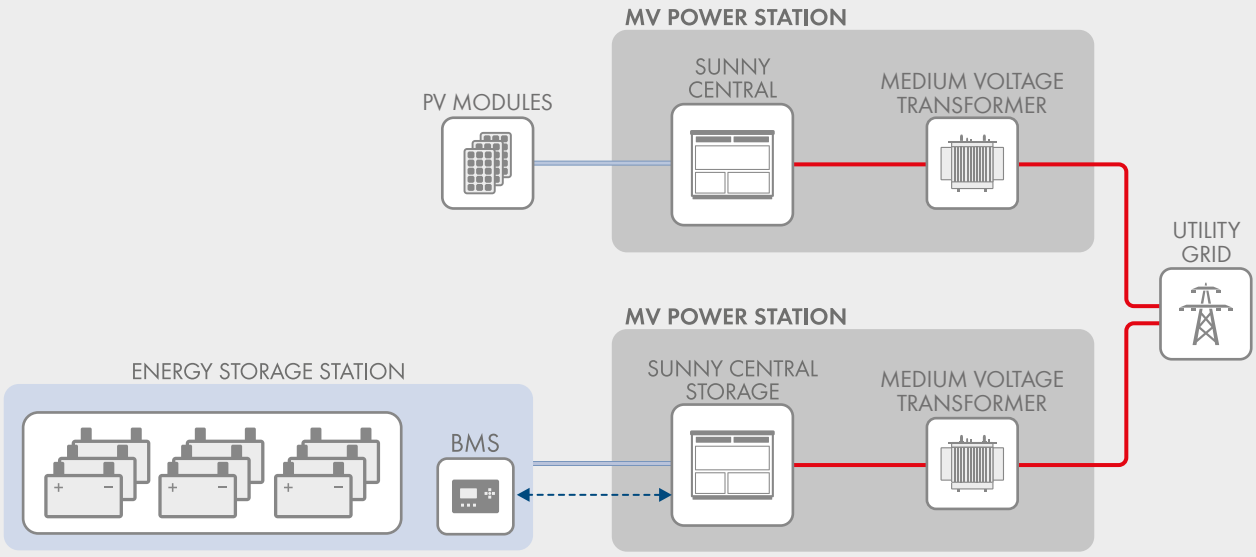
The SMA Energy Storage Station is a standardized container solution to integrate battery storage into photovoltaics systems. It is developed for the majority of use cases associated with renewable sources, especially photovoltaics systems.
It can be connected to the PV generator on the DC-side – using SMA DC-DC Converter – to shift the peak generation to the evening hours of high load demand or connected on the AC-side to perform grid management functions such as frequency and voltage control.
Furthermore, black start capability and grid forming use cases can be supported by the SMA ESS.

# SMA ENERGY STORAGE STATION – Typical Use Cases

## Photovoltaics & Storage - DC Coupled System




## Photovoltaics & Storage - AC Coupled System




DC AC Modbus TCP

| Technical data | ENERGY | MEDIUM | POWER |
|---|---|---|---|
| **Typical Use-Cases** | **Energy Shifting, DC-coupled** | **Grid Services, AC-coupled** | **Frequency control, AC-coupled** |
| **Battery parameters** | | | |
| Nominal Energy DC[1] | 4.5 MWh | 3.9 MWh | 3 MWh |
| Usable Energy DC | | Depending on application | |
| Maximum Power DC | 2.25 MW | 3.9 MW (4.7 MW peak[2]) | 6.0 MW |
| Maximum C-Rate | 0.5CP | 1.0CP (1.2CP peak[2]) | 2.0CP |
| Round Trip Efficiency DC[3] | 94.5 % | 92.5 % | 92.5 % |
| Battery type | | Lithium-ion NMC Technology | |
| **Protective Devices** | | | |
| Disconnection point inside the station | | DC load break switch | |
| DC fuses on battery system level 1 pole / 2 pole | | ● / ○ | |
| DC overvoltage protection in the station surge arrestor type 2 | | ● | |
| AC overvoltage protection in the station surge arrestor type 1 | | ● | |
| Lightning protection on station level | | ○ | |
| Insulation monitoring / Residual current monitoring | | ○ / ○ | |
| Degree of protection | | IP54 | |
| Fire detection smoke detectors / aspirating smoke detection | | ● / ○ | |
| Fire alarming | | optical & acustical on each front side | |
| Fire suppression IG-55 incl. pressure relief flap | | ○ | |
| Humidity control acc. battery requirements | | ● | |
| Temperature control acc. battery requirements | | ● | |
| **Monitoring and control** | | | |
| Monitoring of battery performance data | | monitoring and logging of relevant battery and ambient data | |
| BMS control interface to the inverter | | harmonized with SMA Sunny Central / Sunny Central Storage Series | |
| Monitoring of ambient condtions in the station | | humidity & temperature | |
| Local data logging / remote data storage (cloud based) | | ○ / ○[4] | |
| Reporting on system level | | ○ | |
| Alarming on component level | | supervision HVAC, F&G, BMS, Aux supply, door contacts, surge arrestors | |
| **System compatibility** | | | |
| Compatible Inverters & DC-DC Converters | | SUNNY CENTRAL UP/ SUNNY CENTRAL STORAGE / SMA DC-DC Converter | |
| Number of DC-DC converters per station (DC-coupled) | 2 to 6 | 6 | n/a |
| Number of battery inverters per station (AC-coupled) | 0.5 to 1 | 1 to 2 | 2 |
| **General data** | | | |
| Station design concept | | central gangway with 2 escape doors | |
| Outer dimensions (L / H / W) | | 12192 / 2896 / 2438 mm | |
| max. weight: during transport / installed (populated with battery modules) | | 12 tons / 50 tons[5] | |
| Power consumption (max./ av.)[6] | 35 kVA / 7 kVA | 50 kVA / 10 kVA | 50 kVA / 10 kVA |
| Ambient operating temperature range | | −10 °C to 48 °C (50 °C) | |
| Max. sound pressure level[7] | 58 dB(A) | 54 dB(A) | 54 dB(A) |
| Interior relative humidity | | < 80% | |
| Not weather protected outdoor environment[8] | | ● | |
| Aggressive environmental conditions[9] (sand storm area, highly dusty, salty seaside air etc.) | | ○ | |
| Maximum operating altitude meters above sea level | | 1000 m | |
| **Standards and directives**[10] | | | |
| Station level | | IEC 62485-5 | |
| Cell / module level | | IEC 62619, UL 9540A[11] | |
| | | | |
| ● Standard features ○ Optional – not available | | | |
| | | | |
| Type designation AC coupling | ESS-AC-Energy | ESS-AC-Medium | ESS-AC-Power |
| Type designation DC coupling | ESS-DC-Energy | ESS-DC-Medium | – |

1) with maximum loaded container, reduced nominal energy is possible with partial loading
2) peak operation 5 min, only discharge
3) average based on target C-rate, depends on the current rating during respective operation, more details upon request
4) at least one feature is mandatory for warranty granted
5) dependent on application
6) For 25 °C ambient temperature. Average values are estimates: HVAC and module fans Medium / Power running at 20% load during daytime. Can vary depending on final configuration and site conditions.
7) max. sound pressure level at10 m distance
8) rain shield for external HVAC units in heavy rain areas recommended
9) to be determined acc. specific site conditions
10) for details see separate overview
11) Listing of battery modules pending

# MV POWER STATION
# 4000-S2 / 4200-S2 / 4400-S2 / 4600-S2

MVPS-4000-S2 / MVPS-4200-S2 / MVPS-4400-S2 / MVPS-4600-S2


**Robust**
- Station and all individual components type-tested
- Optimally suited to extreme ambient conditions

**Easy to Use**
- Plug and play concept
- Completely pre-assembled for easy set-up and commissioning

**Cost-Effective**
- Easy planning and installation
- Low transport costs due to 20-foot skid

**Flexible**
- One design for the whole world
- DC-Coupling Ready
- Numerous options

## MV POWER STATION 4000-S2 / 4200-S2 / 4400-S2 / 4600-S2

Turnkey Solution for PV Power Plants and large-scale storage systems

With the power of the new robust central inverters, the Sunny Central UP or Sunny Central Storage UP, and with perfectly adapted medium-voltage components, the new MV Power Station offers even more power density and is a turnkey solution available worldwide. Being the ideal choice for the new generation of PV power plants operating at 1500 VDC, the integrated system solution is easy to transport and quick to assemble and commission. The MVPS and all components are type-tested. The MV Power Station combines rigorous plant safety with maximum energy yield and minimized deployment and operating risk. The MV Power Station is prepared for DC coupling.

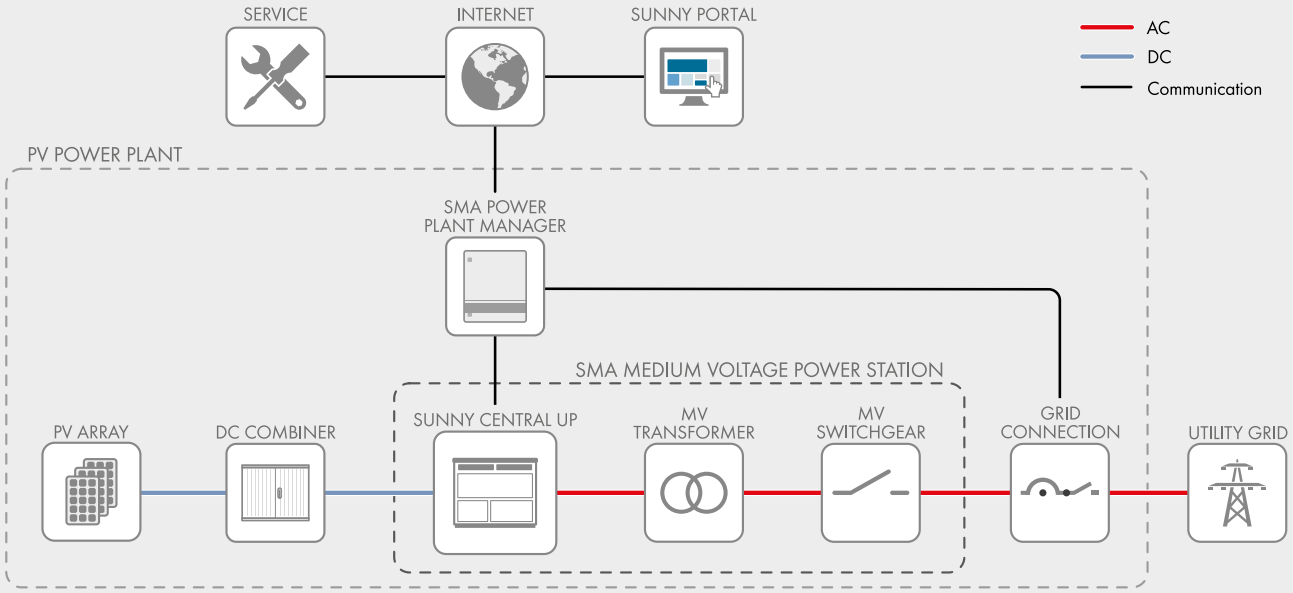
# MV POWER STATION
# 4000-S2 / 4200-S2 / 4400-S2 / 4600-S2

| Technical Data | MVPS 4000-S2 | MVPS 4200-S2 |
|---|---|---|
| **Input (DC)** | | |
| Available inverters | 1 x SC 4000 UP or<br>1 x SCS 3450 UP or<br>1 x SCS 3450 UP-XT | 1 x SC 4200 UP or<br>1 x SCS 3600 UP or<br>1 x SCS 3600 UP-XT |
| Max. input voltage | 1500 V | 1500 V |
| Number of DC inputs | dependent on the selected inverters | |
| Integrated zone monitoring | ○ | |
| Available DC fuse sizes (per input) | 200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A | |
| **Output (AC) on the medium-voltage side** | | |
| Rated power at SC UP (at -25°C to + 25°C / 40°C optional 50°C)[1] | 4000 kVA / 3400 kVA | 4200 kVA / 3570 kVA |
| Rated power at SCS UP (at -25°C bis +25°C / 40°C optional 50°C)[1] | 3450 kVA / 2880 kVA | 3620 kVA / 3020 kVA |
| Charging power at SCS UP-XT (at -25°C bis +25°C / 40°C optional 50°C)[1] | 3450 kVA / 2880 kVA | 3620 kVA / 3020 kVA |
| Discharging power at SCS UP-XT (at -25°C bis +25°C / 40°C optional 50°C)[1] | 4000 kVA / 3400 kVA | 4200 kVA / 3570 kVA |
| Typical nominal AC voltages | 11 kV to 35 kV | 11 kV to 35 kV |
| AC power frequency | 50 Hz / 60 Hz | 50 Hz / 60 Hz |
| Transformer vector group Dy11 / YNd11 / YNy0 | ● / ○ / ○ | ● / ○ / ○ |
| Transformer cooling methods | KNAN[2] | KNAN[2] |
| Transformer no-load losses Standard / Eco Design 1 / Eco Design 2 | ● / ○ / ○ | ● / ○ / ○ |
| Transformer short-circuit losses Standard / Eco Design 1 / Eco Design 2 | ● / ○ / ○ | ● / ○ / ○ |
| Max. total harmonic distortion | < 3% | |
| Reactive power feed-in (up to 60% of nominal power) | ○ | |
| Power factor at rated power / displacement power factor adjustable | 1 / 0.8 overexcited to 0.8 underexcited | |
| **Inverter efficiency** | | |
| Max. efficiency[3] / European efficiency[3] / CEC weighted efficiency[4] | 98.7% / 98.6% / 98.5% | 98.7% / 98.6% / 98.5% |
| **Protective devices** | | |
| Input-side disconnection point | DC load-break switch | |
| Output-side disconnection point | Medium-voltage vacuum circuit breaker | |
| DC overvoltage protection | Surge arrester type I | |
| Galvanic isolation | ● | |
| Internal arc classification medium-voltage control room (according to IEC 62271-202) | IAC A 20 kA 1 s | |
| **General Data** | | |
| Dimensions equal to 20-foot HC shipping container (W / H / D) | 6058 mm / 2896 mm / 2438 mm | |
| Weight | < 18 t | |
| Self-consumption (max. / partial load / average)[1] | < 8.1 kW / < 1.8 kW / < 2.0 kW | |
| Self-consumption (stand-by)[1] | < 370 W | |
| Ambient temperature -25°C to +45°C / -25°C to +55°C / -40°C to +45°C | ● / ○ / ○ | |
| Degree of protection according to IEC 60529 | Control rooms IP23D, inverter electronics IP54 | |
| Environment: standard / harsh | ● / ○ | |
| Degree of protection according to IEC 60721-3-4 (4C1, 4S2 / 4C2, 4S4) | ● / ○ | |
| Maximum permissible value for relative humidity | 95% (for 2 months/year) | |
| Max. operating altitude above mean sea level 1000 m / 2000 m | ● / ○ | |
| Fresh air consumption of inverter | 6500 m³/h | |
| **Features** | | |
| DC terminal | Terminal lug | |
| AC connection | Outer-cone angle plug | |
| Tap changer for MV-transformer: without / with | ● / ○ | |
| Shield winding for MV-Transformer: without / with | ● / ○ | |
| Monitoring package | ○ | |
| Station enclosure color | RAL 7004 | |
| Transformer for external loads: without / 10 / 20 / 30 / 40 / 50 / 60 kVA | ● / ○ / ○ / ○ / ○ / ○ / ○ | |
| Medium-voltage switchgear: without / 1 feeder / 3 feeders<br>2 cable feeders with load-break switch, 1 transformer feeder with circuit breaker, internal arc classification IAC A FL 20 kA 1 s according to IEC 62271-200 | ● / ○ / ○ | |
| Short circuit rating medium voltage switchgear (20 kA 1 s / 20 kA 3 s / 25 kA 1s) | ● / ○ / ○ | |
| Accessories for medium-voltage switchgear: without / auxiliary contacts / motor for transformer feeder / cascade control / monitoring | ● / ○ / ○ / ○ / ○ | |
| Integrated oil containment: without / with | ● / ○ | |
| Industry standards (for other standards see the inverter datasheet) | IEC 60076, IEC 62271-200, IEC 62271-202, EN50588-1, CSC Certificate | |
| | | |
| ● Standard features ○ Optional features – Not available | | |
| | | |
| Type designation | MVPS-4000-S2 | MVPS-4200-S2 |

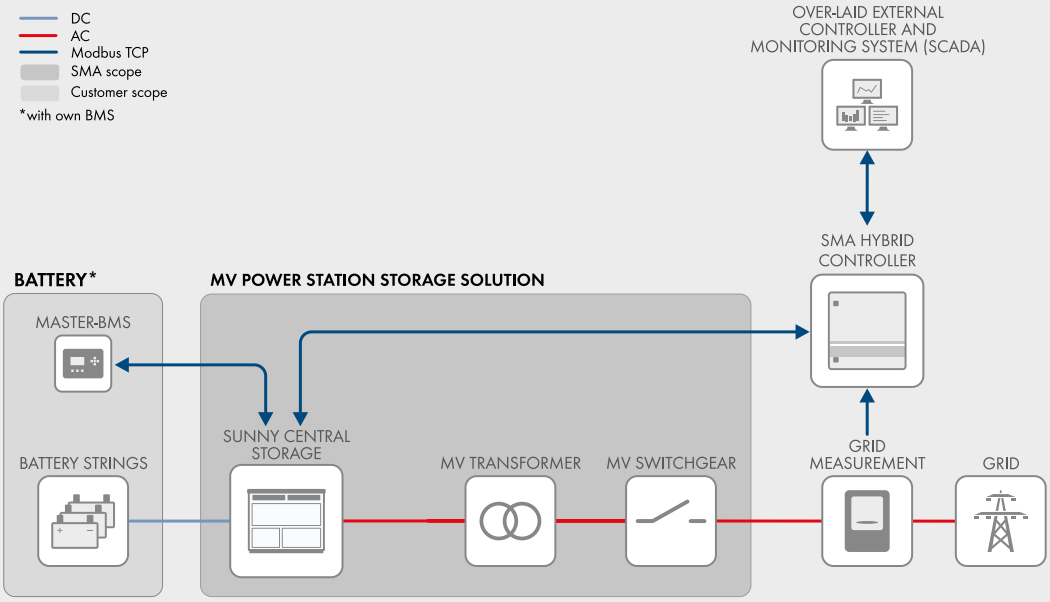
1) Data based on inverter. Further details can be found in the data sheet of the inverter.
2) KNAN = Ester with natural air cooling
3) Efficiency measured at inverter without internal power supply
4) Efficiency measured at inverter with internal power supply

| Technical Data | MVPS 4400-S2 | MVPS 4600-S2 |
|---|---|---|
| **Input (DC)** | | |
| Available inverters | 1 x SC 4400 UP or<br>1 x SCS 3800 UP or<br>1 x SCS 3800 UP-XT | 1 x SC 4600 UP or<br>1 x SCS 3950 UP or<br>1 x SCS 3950 UP-XT |
| Max. input voltage | 1500 V | 1500 V |
| Number of DC inputs | dependent on the selected inverters | |
| Integrated zone monitoring | ○ | |
| Available DC fuse sizes (per input) | 200 A, 250 A, 315 A, 350 A, 400 A, 450 A, 500 A | |
| **Output (AC) on the medium-voltage side** | | |
| Rated power at SC UP (at -25°C to + 25°C / 40°C optional 50°C)[1] | 4400 kVA / 3740 kVA | 4600 kVA / 3910 kVA |
| Rated power at SCS UP (at -25°C bis +25°C / 40°C optional 50°C)[1] | 3800 kVA / 3170 kVA | 3960 kVA / 3310 kVA |
| Charging power at SCS UP-XT (at -25°C bis +25°C / 40°C optional 50°C)[1] | 3800 kVA / 3170 kVA | 3960 kVA / 3310 kVA |
| Discharging power at SCS UP-XT (at -25°C bis +25°C / 40°C optional 50°C)[1] | 4400 kVA / 3740 kVA | 4600 kVA / 3910 kVA |
| Typical nominal AC voltages | 11 kV to 35 kV | 11 kV to 35 kV |
| AC power frequency | 50 Hz / 60 Hz | 50 Hz / 60 Hz |
| Transformer vector group Dy11 / YNd11 / YNy0 | ● / ○ / ○ | ● / ○ / ○ |
| Transformer cooling methods | KNAN[2] | KNAN[2] |
| Transformer no-load losses Standard / Eco Design 1 / Eco Design 2 | ● / ○ / ○ | ● / ○ / ○ |
| Transformer short-circuit losses Standard / Eco Design 1 / Eco Design 2 | ● / ○ / ○ | ● / ○ / ○ |
| Max. total harmonic distortion | < 3% | |
| Reactive power feed-in (up to 60% of nominal power) | ○ | |
| Power factor at rated power / displacement power factor adjustable | 1 / 0.8 overexcited to 0.8 underexcited | |
| **Inverter efficiency** | | |
| Max. efficiency[3] / European efficiency[3] / CEC weighted efficiency[4] | 98.7% / 98.6% / 98.5% | 98.7% / 98.6% / 98.5% |
| **Protective devices** | | |
| Input-side disconnection point | DC load-break switch | |
| Output-side disconnection point | Medium-voltage vacuum circuit breaker | |
| DC overvoltage protection | Surge arrester type I | |
| Galvanic isolation | ● | |
| Internal arc classification medium-voltage control room (according to IEC 62271-202) | IAC A 20 kA 1 s | |
| **General Data** | | |
| Dimensions equal to 20-foot HC shipping container (W / H / D) | 6058 mm / 2896 mm / 2438 mm | |
| Weight | < 18 t | |
| Self-consumption (max. / partial load / average)[1] | < 8.1 kW / < 1.8 kW / < 2.0 kW | |
| Self-consumption (stand-by)[1] | < 370 W | |
| Ambient temperature -25°C to +45°C / -25°C to +55°C / -40°C to +45°C | ● / ○ / ○ | |
| Degree of protection according to IEC 60529 | Control rooms IP23D, inverter electronics IP54 | |
| Environment: standard / harsh | ● / ○ | |
| Degree of protection according to IEC 60721-3-4 (4C1, 4S2 / 4C2, 4S4) | ● / ○ | |
| Maximum permissible value for relative humidity | 95% (for 2 months/year) | |
| Max. operating altitude above mean sea level 1000 m / 2000 m | ● / ○ | |
| Fresh air consumption of inverter | 6500 m³/h | |
| **Features** | | |
| DC terminal | Terminal lug | |
| AC connection | Outer-cone angle plug | |
| Tap changer for MV-transformer: without / with | ● / ○ | |
| Shield winding for MV-Transformer: without / with | ● / ○ | |
| Monitoring package | ○ | |
| Station enclosure color | RAL 7004 | |
| Transformer for external loads: without / 10 / 20 / 30 / 40 / 50 / 60 kVA | ● / ○ / ○ / ○ / ○ / ○ / ○ | |
| Medium-voltage switchgear: without / 1 feeder / 3 feeders<br>2 cable feeders with load-break switch, 1 transformer feeder with circuit breaker, internal arc classification IAC A FL 20 kA 1 s according to IEC 62271-200 | ● / ○ / ○ | |
| Short circuit rating medium voltage switchgear (20 kA 1 s / 20 kA 3 s / 25 kA 1s) | ● / ○ / ○ | |
| Accessories for medium-voltage switchgear: without / auxiliary contacts / motor for transformer feeder / cascade control / monitoring | ● / ○ / ○ / ○ / ○ | |
| Integrated oil containment: without / with | ● / ○ | |
| Industry standards (for other standards see the inverter datasheet) | IEC 60076, IEC 62271-200, IEC 62271-202, EN50588-1, CSC Certificate | |
| | | |
| ● Standard features ○ Optional features – Not available | | |
| | | |
| Type designation | MVPS-4400-S2 | MVPS-4600-S2 |

## System diagram with Sunny Central UP




## System diagram with Sunny Central Storage UP

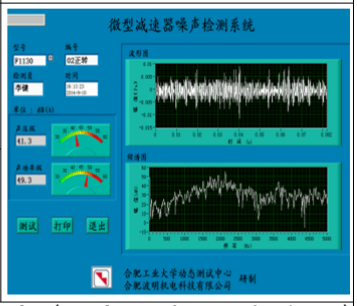


# NEXTracker Motor Sound Test Summary

Each NEXTracker row uses a small 24V DC motor powered by a NEXTracker controller. To track the row, the motor runs for five to ten seconds every few minutes. The noise level of the motors is tested by the manufacturer. Test reports from the manufacturer show that the sound power level is ~50dB. The sound level produced is very low and essentially inaudible to surrounding site noises such as wind or generators.

**Sound testing report**

applying date: Sep, 10th, 2014 report NO.: 2014091001

| | | | | | |
|---|---|---|---|---|---|
| Sample from | Reducer department | P/N | BL-65150-710/5 | Applying department | Quality department |
| Sample | Motor reducer | NO. | 02（CW） | QTY | 2Pcs |
| purpose | check the sound of motor reducer in no-load condition | | | | |
| Testing environment | 1、anechoic chamber inner size: **2850x2750x2100mm**;<br>2、anechoic chamber LF cut-off frequency about **100Hz**;<br>3、inside background noise during work: about **26dB(A)**以下;<br>4、outside vibration transmission less than **5%**;<br>5、motor reduce was under no-load condition when testing. | | | | |
| level | Conform to standard **GB/T3767-1996、ISO3744-1994** | | | | |
| oscillogram |  | | | | |
| spectrogram | | | | | |
| Testing result (away from sound source by 1 meter) unit:db(A) | | | | | |
| Sound power level | | | 49.30 | | |

*Manufacturer sound test report*

Inverse distance law for acoustics shows sound decrease with distance:

| Distance | Sound Level | Equivalent sound |
|---|---|---|
| 3 m (9.8 ft) | ~ 40 dB | Library |
| 30 (98 ft) | ~20 dB | Rustling leaves |
| 300 m (980 ft) | ~0 dB | Inaudible |