

## **Borg Panels Facility**

# **Noise Verification Study of Material Handling Equipment**

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Prepared for Borg Construction Pty Ltd

August 2022

# Borg Panels Facility

## Noise Verification Study of Material Handling Equipment

Borg Construction Pty Ltd

E22075 RP#1

August 2022

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|         |            |             |              |          |

Approved by



**Jesse Tribby**

Senior Acoustic Consultant

24/08/2022

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# 1 Introduction

## 1.1 Background

Global Acoustics (now part of EMM) was engaged by Borg Manufacturing Pty Ltd to undertake a noise verification study for commissioning of a gas turbine and ancillary equipment at the Borg panel manufacturing facility (Borg) at Oberon, NSW. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with specified limits.

Condition B20(B) of the Borg Development Consent SSD 7016 requires a noise validation survey within three months of commissioning of material handling equipment, with assessment against noise limits specified in Condition B16. Commissioning of the material handling equipment was completed on 1 June 2022.

Attended environmental noise monitoring described in this report was done during the day, evening, and night periods of 28 and 29 June 2022 at four monitoring locations. Borg was confirmed to be fully operating during all measurements.

## 1.2 Monitoring locations

Monitoring locations are detailed in Table 1.1 and shown in Figure 1.1. It should be noted that Figure 1.1 shows actual monitoring positions, not the location of residences.

**Table 1.1** Attended monitoring locations

| Location Descriptor | Monitoring Locations                           |
|---------------------|--|
| NM1                 | Oberon Caravan Park                            |
| NM2                 | Intersection of Pine Street and Herborn Street |
| NM3                 | 127 Hazelgrove Road                            |
| NM4                 | Intersection of Tasman Street and Earl Street  |



Figure 1.1 Borg noise monitoring locations

### 1.3 Terminology and abbreviations

Some definitions of terms and abbreviations which may be used in this report are provided in Table 1.2

**Table 1.2 Terminology and abbreviations**

| Descriptor              | Definition   |
|-------------------------|--|
| dB(A)                   | Noise level measurement units are decibels (dB). The “A” weighting scale is used to describe human response to noise.  |
| L <sub>Amax</sub>       | The maximum A-weighted noise level over a time period.   |
| L <sub>A1</sub>         | The noise level which is exceeded for 1 per cent of the time.  |
| L <sub>A1,1minute</sub> | The noise level which is exceeded for 1 per cent of the specified time period of 1 minute.   |
| L <sub>A10</sub>        | The noise level which is exceeded for 10 percent of the time.  |
| L <sub>Aeq</sub>        | The average noise A-weighted energy during a measurement period.   |
| L <sub>A50</sub>        | The noise level which is exceeded for 50 per cent of the time and the median noise level during a measurement period.  |
| L <sub>A90</sub>        | The level exceeded for 90 percent of the time. The L <sub>A90</sub> level is often referred to as the “background” noise level and is commonly used to determine noise criteria for assessment purposes. |
| L <sub>Amin</sub>       | The minimum A-weighted noise level over a time period.   |
| L <sub>Ceq</sub>        | The average C-weighted noise energy during a measurement period. The “C” weighting scale is used to take into account low-frequency components of noise within the audibility range of humans.           |
| SPL                     | Sound pressure level. Fluctuations in pressure measured as 10 times a logarithmic scale, with the reference pressure being 20 micropascals.  |
| Hertz (Hz)              | The frequency of fluctuations in pressure, measured in cycles per second. Most sounds are a combination of many frequencies together.  |
| AWS                     | Automatic weather station used to collect meteorological data, typically at an altitude of 10 metres   |
| VTG                     | Vertical temperature gradient in degrees Celsius per 100 metres altitude.  |
| Sigma-theta             | The standard deviation of the horizontal wind direction over a period of time.   |
| SC                      | Stability class (or category) is determined from measured wind speed and either sigma-theta or VTG.  |
| IA                      | Inaudible. When site noise is noted as IA then there was no site noise at the monitoring location.   |
| NM                      | Not Measurable. If site noise is noted as NM, this means some noise was audible but could not be quantified.   |
| Day                     | This is the period 7:00am to 6:00pm.   |
| Evening                 | This is the period 6:00pm to 10:00pm.  |
| Night                   | This is the period 10:00pm to 7:00am.  |

## 2 Regulator requirements and noise criteria

### 2.1 Development consents

The most current development consent associated with activities at Borg is Development Consent SSD 7016 (the consent), most recently modified 20 May 2022. Relevant conditions of the consent, requiring commissioning testing described in this report, are reproduced in Appendix B.

### 2.2 Environment protection licence

Borg holds Environment Protection Licence (EPL) No. 3035 issued by the Environment Protection Authority (EPA) most recently on 2 February 2022.

### 2.3 Operational Noise Management Plan

Noise monitoring requirements are detailed in the Borg Operational Noise Management Plan (ONMP) and Construction Noise Management Plan (CNMP). The most recent version of the ONMP was approved in October 2020. The most recent version of the CNMP was approved in May 2021.

### 2.4 Noise Criteria

Noise limits are consistent between the consent and EPL and have been reproduced in Table 2.1 below.

**Table 2.1** Impact assessment criteria

| Location                | Day $L_{Aeq,15minute}$ | Evening $L_{Aeq,15minute}$ | Night $L_{Aeq,15minute}$ |
|-------------------------|------------------------|----------------------------|--------------------------|
| All sensitive receivers | 55                     | 50                         | 45                       |

### 2.5 Meteorological conditions

As described in the consent, noise generated by Borg is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy (INP), as follows:

- *During rain and wind speeds greater than 3 metres/second at 10 metres above ground level; or*
- *Stability category F temperature inversion conditions and wind speeds greater than 2 metres/second at 10 metres above ground level; or*
- *Stability category G temperature inversion conditions.*

### 2.6 Modifying factors

The EPA 'Noise Policy for Industry' (NPfI, 2017) was approved for use in NSW in October 2017. For assessment of modifying factors, the NPfI immediately superseded the 'Industrial Noise Policy' (INP, 2000), as outlined in the EPA document 'Implementation and transitional arrangements for the Noise Policy for Industry' (2017). Assessment and reporting of modifying factors has been done in accordance with Fact Sheet C of the NPfI.

## 3 Methodology

### 3.1 Overview

Attended environmental noise monitoring was conducted in general accordance with Australian Standard AS1055 'Acoustics, Description and Measurement of Environmental Noise', relevant NSW EPA requirements, and the Borg ONMP. Meteorological data was obtained from the Borg automatic weather station (AWS) which allowed correlation of atmospheric parameters with measured noise levels.

### 3.2 Attended noise monitoring

During this survey, attended monitoring was done during the day, evening and night period at each location. The duration of each measurement was 15 minutes. Atmospheric conditions were also measured at each monitoring location.

This survey presents noise levels gathered during attended monitoring that can be the result of many sounds reaching the sound level meter microphone during monitoring. Received levels from various noise sources were noted during attended monitoring and particular attention was paid to the extent of Borg's contribution, if any, to measured levels. At each receptor location, Borg's  $L_{Aeq,15\text{minute}}$  (in the absence of any other noise) was measured directly, where possible, or, determined by frequency analysis.

If the exact contribution of the source of interest (in this case Borg) cannot be established, due to masking by other noise sources in a similar frequency range, but site noise levels are observed to be well below (more than 5 dB lower than) any relevant criterion, a maximum estimate of the potential contribution of the site might be made based on other measured site-only noise descriptors in accordance with Section 7.1 of the NPfl. This is generally expressed as a 'less than' quantity, such as <20 dB or <30 dB.

The terms 'Inaudible' (IA) or 'Not Measurable' (NM) may also be used in this report. When site noise is noted as IA, no site noise was audible at the monitoring location. When site noise is noted as NM, this means some noise was audible but could not be quantified. If site noise was NM due to masking but estimated to be significant in relation to a relevant criterion, we would employ methods (eg. measure closer and back calculate) to determine a value for reporting.

All sites noted as NM in this report are due to one or more of the following reasons:

- Site noise levels were extremely low and unlikely, in many cases, to be even noticed.
- Site noise levels were masked by another relatively loud noise source that is characteristic of the environment (eg breeze in foliage or continuous road traffic noise) that cannot be eliminated by moving closer.
- It was not feasible, nor reasonable to employ methods such as move closer and back calculate. Cases may include, but are not limited to, rough terrain preventing closer measurement, addition/removal of significant source to receiver shielding caused by moving closer, and meteorological conditions where back calculation may not be accurate.

Often extraneous noise events (for example, road traffic pass-bys and dogs) interfere with the measurement of site noise levels in the frequency range of interest. Where required, the sound level meter is paused during these occurrences to aid in quantification of the site only noise.

### 3.3 Modifying factors

All measurements were evaluated for potential modifying factors in accordance with the NPfl. Specific methodology for assessment of each modifying factor is outlined in Fact Sheet C of the NPfl.

Assessment of modifying factors is undertaken at the time of measurement if the site was audible and directly quantifiable, such that the site only  $L_{Aeq}$  was not “NM” or less than a maximum cut off value (eg “<20 dB” or “<30dB”).

If applicable, modifying factors have been reported and added to measured site only  $L_{Aeq}$  when meteorological conditions satisfied requirements for site noise criteria to be applicable. Low-frequency modifying factors have only been applied to site-only  $L_{Aeq}$  if Borg was the only contributing low-frequency noise source.

### 3.4 Attended noise monitoring equipment

Equipment used to measure environmental noise levels is detailed in Table 3.1. Calibration certificates are provided in Appendix A.

**Table 3.1** Attended noise monitoring equipment

| Model                          | Serial number | Calibration due date |
|--------------------------------|---------------|----------------------|
| Rion NA-28 sound level meter   | 01070590      | 09/06/2024           |
| Pulsar 106 acoustic calibrator | 74813         | 09/06/2024           |

## 4 Results

### 4.1 Total measured noise levels

Overall noise levels measured at each location during attended monitoring are provided in Table 4.1.

**Table 4.1** Measured noise levels<sup>1</sup>

| Location | Start Date and Time | L <sub>Amax</sub><br>dB | L <sub>A1</sub><br>dB | L <sub>A10</sub><br>dB | L <sub>Aeq</sub><br>dB | L <sub>A50</sub><br>dB | L <sub>A90</sub><br>dB | L <sub>Amin</sub><br>dB |
|----------|---------------------|-------------------------|-----------------------|------------------------|------------------------|------------------------|------------------------|-------------------------|
| NM1      | 28/06/2022 19:05    | 53                      | 50                    | 48                     | 46                     | 46                     | 45                     | 43                      |
| NM1      | 28/06/2022 22:27    | 55                      | 49                    | 47                     | 46                     | 45                     | 44                     | 42                      |
| NM1      | 29/06/2022 10:30    | 65                      | 60                    | 55                     | 52                     | 51                     | 49                     | 27                      |
| NM2      | 28/06/2022 18:35    | 52                      | 49                    | 48                     | 46                     | 46                     | 45                     | 43                      |
| NM2      | 28/06/2022 22:00    | 50                      | 46                    | 45                     | 43                     | 43                     | 41                     | 39                      |
| NM2      | 29/06/2022 10:00    | 60                      | 54                    | 50                     | 48                     | 47                     | 45                     | 43                      |
| NM3      | 28/06/2022 20:15    | 73                      | 65                    | 44                     | 50                     | 42                     | 40                     | 35                      |
| NM3      | 28/06/2022 23:32    | 58                      | 52                    | 43                     | 42                     | 39                     | 36                     | 30                      |
| NM3      | 29/06/2022 11:37    | 76                      | 70                    | 58                     | 57                     | 46                     | 44                     | 41                      |
| NM4      | 28/06/2022 19:36    | 44                      | 40                    | 36                     | 34                     | 33                     | 31                     | 29                      |
| NM4      | 28/06/2022 23:00    | 46                      | 41                    | 37                     | 35                     | 34                     | 33                     | 31                      |
| NM4      | 29/06/2022 11:06    | 61                      | 54                    | 50                     | 48                     | 48                     | 45                     | 42                      |

1. Levels in this table are not necessarily the result of activity at Borg

### 4.2 Modifying factors

Measured site only levels were assessed for the applicability of modifying factors in accordance with the NPfI and methodology described in Section 3.3.

There were no modifying factors, as defined in the NPfI, applicable during the survey.

### 4.3 Attended noise monitoring results

Table 4.2 compares measured  $L_{Aeq,15\text{minute}}$  from Borg with project specific noise criteria.

**Table 4.2**  $L_{Aeq,15\text{minute}}$  generated by Borg against criteria

| Location | Start Date and Time | Wind Speed m/s | Stability Class | Criterion dB | Criterion Applies? <sup>1</sup> | Borg $L_{Aeq,15\text{minute}}$ dB <sup>2</sup> | Exceedance <sup>3,4</sup> |
|----------|---------------------|----------------|-----------------|--------------|---------------------------------|--|---------------------------|
| NM1      | 28/06/2022 19:05    | 2.7            | D               | 50           | Yes                             | 43   | Nil                       |
| NM1      | 28/06/2022 22:27    | 3.9            | D               | 45           | No                              | 45   | NA                        |
| NM1      | 29/06/2022 10:30    | 5.2            | D               | 55           | No                              | 48   | NA                        |
| NM2      | 28/06/2022 18:35    | 3.0            | D               | 50           | Yes                             | 42   | Nil                       |
| NM2      | 28/06/2022 22:00    | 4.3            | D               | 45           | No                              | 41   | NA                        |
| NM2      | 29/06/2022 10:00    | 5.7            | D               | 55           | No                              | NM   | NA                        |
| NM3      | 28/06/2022 20:15    | 3.3            | E               | 50           | No                              | IA   | NA                        |
| NM3      | 28/06/2022 23:32    | 2.8            | D               | 45           | Yes                             | <25  | Nil                       |
| NM3      | 29/06/2022 11:37    | 5.2            | C               | 55           | No                              | 40   | NA                        |
| NM4      | 28/06/2022 19:36    | 2.9            | D               | 50           | Yes                             | <30  | Nil                       |
| NM4      | 28/06/2022 23:00    | 2.7            | E               | 45           | Yes                             | <30  | Nil                       |
| NM4      | 29/06/2022 11:06    | 5.5            | D               | 55           | No                              | 45   | NA                        |

1. Noise criteria apply under all meteorological conditions except those detailed in Section 2.5.
2. Site only  $L_{Aeq,15\text{minute}}$  attributed to Borg including modifying factors if applicable.
3. Bold results in red indicate exceedance of criterion (if applicable).
4. NA in exceedance column means atmospheric conditions outside conditions specified, therefore criterion was not applicable.

## 4.4 Atmospheric conditions

Atmospheric condition data measured by the operator during each measurement using a Kestrel hand-held weather meter are shown in Table 4.3. The wind speed, direction and temperature were measured at approximately 1.8 metres. Attended noise monitoring is not undertaken during rain, hail, or wind speeds above 5 m/s at microphone height.

**Table 4.3 Measured atmospheric conditions**

| Location | Start Date and Time | Temperature °C | Wind Speed m/s | Wind Direction ° Magnetic North <sup>1</sup> | Cloud Cover 1/8s |
|----------|---------------------|----------------|----------------|--|------------------|
| NM1      | 28/06/2022 19:05    | 6              | 0.0            | -  | 0                |
| NM1      | 28/06/2022 22:27    | 6              | 1.1            | 250  | 8                |
| NM1      | 29/06/2022 10:30    | 7              | 2.8            | 80   | 4                |
| NM2      | 28/06/2022 18:35    | 5              | 1.2            | 270  | 0                |
| NM2      | 28/06/2022 22:00    | 6              | 1.6            | 240  | 7                |
| NM2      | 29/06/2022 10:00    | 6              | 3.1            | 130  | 3                |
| NM3      | 28/06/2022 20:15    | 5              | 0.4            | 260  | 3                |
| NM3      | 28/06/2022 23:32    | 6              | 1.1            | 250  | 8                |
| NM3      | 29/06/2022 11:37    | 11             | 2.0            | 100  | 3                |
| NM4      | 28/06/2022 19:36    | 4              | 0.6            | 300  | 0                |
| NM4      | 28/06/2022 23:00    | 6              | 3.3            | 270  | 8                |
| NM4      | 29/06/2022 11:06    | 9              | 2.7            | 80   | 3                |

1. "-" indicates calm conditions at monitoring location

Meteorological data for compliance assessment is sourced from Borg AWS.

## 5 Summary

Global Acoustics (now part of EMM) was engaged by Borg Manufacturing Pty Ltd to undertake a noise verification study for commissioning of a gas turbine and ancillary equipment at the Borg panel manufacturing facility (Borg) at Oberon, NSW. The purpose of the survey was to quantify and describe the acoustic environment around the site and compare results with specified limits.

Condition B20(B) of the Borg Development Consent SSD 7016 requires a noise validation survey within three months of commissioning of material handling equipment, with assessment against noise limits specified in Condition B16. Commissioning of the material handling equipment was completed on 1 June 2022.

Attended environmental noise monitoring described in this report was done during the day, evening, and night periods of 28 and 29 June 2022 at four monitoring locations. Borg was confirmed to be fully operating during all measurements.

Borg operations complied with the relevant criteria at all monitoring locations. Criteria may not always be applicable due to meteorological conditions at the time of monitoring.

---

# Appendix A

## Calibration certificates

---

## A.1 Calibration certificates



### Sound Level Meter IEC 61672-3:2013 Calibration Certificate Calibration Number C22373

|   |   |
|---|---|
| <b>Client Details</b>                         | EMM Consulting<br>Suite 6, Level 1, 146 Hunter Street<br>Newcastle NSW 2300 |
| <b>Equipment Tested/ Model Number :</b>       | Rion NA-28  |
| <b>Instrument Serial Number :</b>             | 01070590  |
| <b>Microphone Serial Number :</b>             | 08184   |
| <b>Pre-amplifier Serial Number :</b>          | 52329   |
| <b>Pre-Test Atmospheric Conditions</b>        | <b>Post-Test Atmospheric Conditions</b>                                     |
| Ambient Temperature : 25.7°C                  | Ambient Temperature : 25.4°C  |
| Relative Humidity : 31.9%                     | Relative Humidity : 32.4%   |
| Barometric Pressure : 100.18kPa               | Barometric Pressure : 100.11kPa   |
| <b>Calibration Technician :</b> Lucky Jaiswal | <b>Secondary Check:</b> Max Moore   |
| <b>Calibration Date :</b> 9 Jun 2022          | <b>Report Issue Date :</b> 20 Jun 2022                                      |
| <b>Approved Signatory :</b>                   | Ken Williams  |

| Clause and Characteristic Tested                   | Result | Clause and Characteristic Tested                  | Result |
|--|--------|---|--------|
| 12: Acoustical Sig. tests of a frequency weighting | Pass   | 17: Level linearity incl. the level range control | Pass   |
| 13: Electrical Sig. tests of frequency weightings  | Pass   | 18: Toneburst response                            | Pass   |
| 14: Frequency and time weightings at 1 kHz         | Pass   | 19: C Weighted Peak Sound Level                   | Pass   |
| 15: Long Term Stability                            | Pass   | 20: Overload Indication                           | Pass   |
| 16: Level linearity on the reference level range   | Pass   | 21: High Level Stability                          | Pass   |

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2013, for the environmental conditions under which the tests were performed.

However, no general statement or conclusion can be made about conformance of the sound level meter to the full requirements of IEC 61672-1:2013 because evidence was not publicly available, from an independent testing organisation responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2013 and because the periodic tests of IEC 61672-3:2013 cover only a limited subset of the specifications in IEC 61672-1:2013.

| Uncertainties of Measurement - |         |                          |           |
|--------------------------------|---------|--------------------------|-----------|
| Acoustic Tests                 |         | Environmental Conditions |           |
| 125Hz                          | ±0.13dB | Temperature              | ±0.1°C    |
| 1kHz                           | ±0.13dB | Relative Humidity        | ±1.9%     |
| 8kHz                           | ±0.14dB | Barometric Pressure      | ±0.014kPa |
| Electrical Tests               | ±0.13dB |                          |           |

*All uncertainties are derived at the 95% confidence level with a coverage factor of 2.*



This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.  
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.



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**Sound Calibrator  
IEC 60942:2017**

**Calibration Certificate**

Calibration Number C22374

**Client Details** EMM Consulting  
Suite 6, Level 1, 146 Hunter Street  
Newcastle NSW 2300

**Equipment Tested/ Model Number :** Pulsar Model 106  
**Instrument Serial Number :** 74813

**Atmospheric Conditions**

**Ambient Temperature :** 25.8°C  
**Relative Humidity :** 33.6%  
**Barometric Pressure :** 100.19kPa

**Calibration Technician :** Lucky Jaiswal **Secondary Check:** Max Moore  
**Calibration Date :** 09 Jun 2022 **Report Issue Date :** 20 Jun 2022

**Approved Signatory :**  Ken Williams

| Characteristic Tested          | Result |
|--------------------------------|--------|
| Generated Sound Pressure Level | Pass   |
| Frequency Generated            | Pass   |
| Total Distortion               | Pass   |

| Nominal Level | Nominal Frequency | Measured Level | Measured Frequency |
|---------------|-------------------|----------------|--------------------|
| 94            | 1000              | 94.09          | 1000.30            |

The sound calibrator has been shown to conform to the class 2 requirements for periodic testing, described in Annex B of IEC 60942:2017 for the sound pressure level(s) and frequency(ies) stated, for the environmental conditions under which the tests were performed.

**Uncertainties of Measurement -**

| Specific Tests | Uncertainties of Measurement | Environmental Conditions | Uncertainties of Measurement |
|----------------|------------------------------|--------------------------|------------------------------|
| Generated SPL  | ±0.10dB                      | Temperature              | ±0.1°C                       |
| Frequency      | ±0.13%                       | Relative Humidity        | ±1.9%                        |
| Distortion     | ±0.20%                       | Barometric Pressure      | ±0.014kPa                    |

All uncertainties are derived at the 95% confidence level with a coverage factor of 2.



This calibration certificate is to be read in conjunction with the calibration test report.

Acoustic Research Labs Pty Ltd is NATA Accredited Laboratory Number 14172.  
Accredited for compliance with ISO/IEC 17025 - Calibration.

The results of the tests, calibrations and/or measurements included in this document are traceable to SI units.

NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration and inspection reports.

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# Appendix B

## Regulatory requirements

---

## B.1 Development Consent SSD 7016 MOD 4

### Operational Noise Limits

B16 The Applicant must ensure that noise generated by the Development does not exceed the noise limits in **Table 2**.

**Table 2: Noise Limits dB(A)**

| Location                | Day                          | Evening                      | Night                        |
|-------------------------|------------------------------|------------------------------|------------------------------|
|                         | L <sub>Aeq</sub> (15 minute) | L <sub>Aeq</sub> (15 minute) | L <sub>Aeq</sub> (15 minute) |
| All sensitive receivers | 55                           | 50                           | 45                           |

**Note:** Noise generated by the Development is to be measured in accordance with the relevant procedures and exemptions (including certain meteorological conditions) of the NSW Industrial Noise Policy.

B20B Within three months of commissioning the materials handling equipment approved for installation and operation under SSE 7016 MOD 3, the Applicant must undertake a Noise Verification Study for the Department to the satisfaction of the Secretary. The Study must:

- (a) be undertaken by a suitably qualified expert;
- (b) include an analysis of compliance with noise limits specified in Condition B16;
- (c) include an outline of management actions to be taken to address any exceedances of the limits specified in Condition B16; and
- (d) describe the contingency measures in the event management actions are not effective in reducing noise levels to an acceptable level.

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