Supplier Quality

Assurance Manual (SQAM)

Gietburg b.v.

Version 07-2015

Right first time

Main changes to previous edition:	Previous editions:
Chapter 1-9 reworked	Version 05-2014

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1. Introduction

The mission of Gietburg B.V (hereinafter referred to as "Gietburg") is to deliver high quality cast iron and steel parts, preferably with machining, surface finishing and / or assembly. Selecting suppliers that can meet the ever rising standards and expectations of the market therefore is of the upmost importance.

Delivering parts to satisfaction in terms of all quality aspects is the key aspect of our success. These high standards can only be met by the joint effort of Gietburg and its suppliers.

We expect our suppliers to be committed to a **ZERO DEFECT APPROACH** and to demonstrate this commitment through:

- Delivering fully conforming parts,
- On time delivery,
- Continuous Improvement.

As we are operating in markets where demands are always increasing, the focus of Gietburg and its suppliers must be to continuously improve the quality of products and services delivered.

This document is a guideline for you, our supplier, to meet the requirements expected, both in sampling and in serial production phase.

The latest copy of this document can be found at: www.gietburg.nl

2. Basic requirements

2.1 Supplier selection

Choosing reliable suppliers that deliver high quality castings in all its aspects (quality, delivery performance and cost) is the most important decision to be made by Gietburg. In order to become a supplier, a supplier must pass the audit according to VDA6.3 and have signed the following documents:

- Purchase agreement and pricelist
- Quality agreement
- Potential analysis and/or process audit (VDA 6.3)

Applicable documents:

QA-001	Quality agreement
PA-001	Purchase agreement
QA-002	VDA 6.3
QA-003	Supplier Quality Assurance Manual (SQAM)

2.2 Potential analysis based on VDA 6.3 (P1)

Potential analysis is used for preparing the decision to award a contract to potential suppliers, particularly when awarding contracts for technically demanding or newly developed products. Gietburg uses this to assess the quality capability of potential suppliers. The objective of the initial audit is to successfully introduce a new supplier or product or assess a new location. This means assessing the quality of the supplier in relation to the product and the process as well as establishing processes that meet stringent quality requirements.

2.3 Process audit based on VDA6.3 (P2-P7)

Elements for carrying out the process audit in accordance with VDA are:

VDA 6.3	
Element P2	Project management
Element P3	Planning the product and process development
Element P4	Carrying out the product and process development
Element P5	Supplier management
Element P6	Process analysis / production
Element P7	Customer support, satisfaction , service

The awarding of points or respectively the assessment is done in accordance with a defined system:

Awarding of points - individual assessment of the questions (to VDA standard):

10	Full compliance with the requirements
8	Requirements mainly* satisfied; minor deviations
6	Requirements partially satisfied; significant deviations
4	Requirements inadequately satisfied; major deviations
0	Requirements not satisfied

*) The term "mainly" means that all relevant requirements have been shown as achieved in more than ¾ of all relevant cases and there are no special risks.

Process audit assessment scheme:

Overall fulfilment level as a percentage	Assessment of the processes	Grading of in accordance with VDA standard	Grading of the supplier in accordance with Gietburg standard	
90 to 100	Quality capable	A	1	Unrestricted approval for a specific range of parts , requirements fully fulfilled
80 to 89	Conditionally Quality capable	B	2	Limited approval for a specific range of parts, requirements mostly fulfilled
75 to 79	not yet quality-capable	C	3	With conditions (implementation of an improvement program) with the opportunity of requalification by Gietburg, requirements partially not fulfilled
under 75	not quality capable	C	4	Supplier not approved, requirements not fulfilled, process ended

New suppliers will only get delivery approval above an audit result ≥ 80%.
If the achieved level is between 80% and 90% the supplier is expected to improve > 90% before series release.

On achieving a positive grading this process ends with the supplier being cleared for a business relationship with Gietburg. The grading is valid for a maximum of 5 years. The supplier is obliged to announce in advance any changes that will have an impact when it comes to the renewing of the grading.

2.2 Quality management system

The supplier has effectively introduced a quality management System into his company and with it proves his quality capability. This system complies at least with the requirements of the standard ISO 9001. ISO / TS 16949, ISO 140001 and ISO 50001 is recommended by Gietburg, although not mandatory. As proof the supplier has to submit the valid certificate from an accredited certification company (third party audit).

2.3 Continuous improvement process (CIP)

The supplier has introduced in his company a structured process for continuous improvement of all products, processes (also applies to out-sourced processes), operating procedures and services and can demonstrate that it applies to the products delivered to Gietburg and activities associated with the business relationship. Supplier demonstrates the effectiveness by a continual improvement of his quality performance, delivery performance, flexibility and collaboration.

3. Advanced Product Quality Planning (APQP)

Advanced Product Quality Planning (APQP) is a structured method of continuous project management to track the product and process quality of a component over all phases of the development process. APQP projects are initiated and led by a member of Gietburg development and/or member of Gietburg Sales/Purchasing Department. APQP requirement are depending on the criticality of the component.

APQP improves the communication between all involved persons by standardized procedures to ensure that all necessary steps are implemented in a timely manner.

<u>Some advantages of APQP are:</u>

- Target-orientated capacity planning
- Early identification of problems to initiate changes in a timely manner
- Avoiding changes in late project phases
- Delivering a high quality product in time at lowest costs
- Increased delivery reliability and customer satisfaction

Supplier Advanced Product Quality Planning (APQP)

Clear form

S-APQP-Revision-Level:
Last Revision-Date:

	#	Activity	Supplier Resp.	Planned Start-Date (YYYY-MM-DD)	Planned Due Date (YYYY-MM-DD)	Ready Status 20%	40%	60%	80%	100%	Status	Actual Start-Date (YYYY-MM-DD)	Actual Completion-Date (YYYY-MM-DD)	Follow-up / Comments / References
PHASE 1	1	Project Team												
	2	Serial Order and Drawings / Specification release												
	3	Feasibility Study and Action Plan completed												
	4	Special characteristics												
PHASE 2	5	Process flowchart												
	6	Process FMEA												
	7	Control Plan												
	8	Work instructions / Inspection instructions												
	9	Material Handling and Packaging Instructions												
	10	Special Processes												
PHASE 3	11	First-Production-Trial-Run and Corrective Actions												
	12	PPAP-Production-Run												
	13	Measurement System												
	14	Initial Capability Studies and SPC Plan												
	15	Product / Production Validation												
	16	PPAP Submission												

Applicable documents:

QA004 APQP sheet

4. Production Part Approval Process (PPAP)

The aim of sampling is to prove the capabilities with regard to quality required from the supplier and to check whether the requirements of the drawings or specifications are being fully understood and fulfilled. For all documents requested in PPAP Gietburg has available for the supplier upon request.

4.1 Initial Sample

Initial samples are products which have been manufactured entirely with series production resources and under series production conditions with stable production processes. Number of initial samples to be delivered is stated in the PPAP initial sample purchase order.

4.2 Prototype Sample

Prototype samples are products which can be manufactured without use of the production resources, procedures and conditions. Unless otherwise agreed between supplier and Gietburg, 1 prototype sample needs to be delivered with material test result (according to chapter 4.8) and full dimensional report casting (according to chapter 4.9) and if applicable machining (according to chapter 4.7).

4.3 Initial Sample Inspection

In general PPAP level 4, according to the AIAG (Automotive Industry Action Group) PPAP manual 4th edition, is required. In individual cases this requirement may differ, always in agreement between supplier and Gietburg. Following documents must be submitted with the initial samples. In case of documents to be retained, supplier must have these documents available for review by Gietburg upon request.

	Casted parts	**Machined parts**
1. Process flow chart	Submit	Submit
2. Process FMEA	Submit	Submit
3. Control Plan	Submit	Submit
4. Numbered Drawing	Submit	Submit
5. Material test results	Submit	-
6. Dimensional results	Submit	Submit
7. Part Submission Warrant (P.S.W.)	Submit	Submit
8. Statistical process control (S.P.C.)	Retain	Retain
9. Measurement Systems Analysis (M.S.A)	-	Retain
10. Part specific Workplan	Submit	Submit

4.3.1 Sending PPAP documents

PPAP document shall be send to Quality@gietburg.nl

NOTE
PPAP samples are to be resubmitted without special request:

- When there is a change in production processes and/or production conditions which might influence dimensions, materials, material characteristics and functions.
- When there is a change in internal or external production (e.g. subcontractor)

4.4 Process flow chart

A process flow chart must clearly describe all production process steps and sequences.
The process flowchart is a schematic representation of the process, which describes all steps to be taken to produce a part. It must contain steps to be taken if a process is out of specification.

4.5 Process FMEA

A process FMEA (Failure Mode and Effect Analysis) will be done by supplier. A FMEA is conducted prior to start-up of part production, in order to determine potential failures within the entire manufacturing process of a certain part. In a FMEA the supplier evaluates the various process steps stated in the process flowchart and determines the potential failure modes. When all potential failure modes are determined the supplier must assess these and give a score between 1 and 10 for the following parameters, severity (how severe are the consequences of the potential failure mode), occurrence (how high are the chances of a potential failure mode to occur) and detection (what are the chances of detection of the potential failure mode).

The risk level for each process step is quantified using a Risk Priority Number (RPN) that typically ranges from 1 to 1.000, with 1.000 being the highest possible risk level. The RPN is a product of three risk factors.

RPN = Severity x Occurrence x Detection

It is expected of the supplier to take action if the RPN of a potential failure mode is above 100. In such a case in the worksheet there should be stated a recommended action and new assessment needs to be done over severity, occurrence and detection, this step must be repeated until an RPN smaller than 100 is in place.

For score ranking of severity occurrence and detection see AIAG FMEA manual 4th edition.

The supplier is responsible for conducting a realistic process FMEA, which accurately states the potential failure mode with a realistic RPN score.

4.6 Control Plan

Control plan contents, the supplier will supply a control plan for each project / new product developed / altered product or produced according to the PPAP manual (Latest Edition) and APQP manual (Latest Edition). This must detail all Quality Control processes used to ensure the quality (by minimising process and product variation) of product shipped to Gietburg. The Control Plan must be maintained throughout the products life cycle, and is updated whenever systems and control methods are evaluated or improved.

4.7 Numbered drawing

In case of machined parts also a numbered drawing of the machined part must be submitted with the initial samples. On a numbered drawing all dimensions, remarks and reference to specifications must be numbered. Boxed dimensions and dimensions in parentheses must be numbered (and can be rewarded with “OK” or the value of the nominal dimension in the dimensional report). The numbered drawing should be used as a reference for the dimensional report (see paragraph 4.10)

4.8 Material Test Results

Material test results must be submitted by the supplier in the sampling phase. This report must contain:

- Unless otherwise agreed between supplier and Gietburg, chemical analysis of the material according to specification as stated on the drawing and/or customers material specification. The customer specification has to been stated on the material report
- Measured value for each element with applicable tolerances
- Mechanical properties according to specification stated on drawing
- Etched and non-etched picture of microscopic structure with magnification ratio specified.

In addition extra information can be needed for certain materials, Gietburg will notify supplier if applicable.

4.9 Dimensional result initial sample casting

To ensure that a castings meets the dimension specification according to drawing, the supplier must submit a dimensional report by means of a 3D scanning device. As a means of service Gietburg can provide a 3D Scan at cost of supplier. Unless otherwise agreed, a 3D scan is necessary for each cavity. If no (reliable) 3D model is present a 2D dimensional report of the casting has to be supplied.

4.9.1 Alignment

BestFit alignment
Automatic alignment of the determined points/surfaces so that the smallest possible deviations are reached

RPS alignment
The part is aligned (centered) according the 3-2-1 clamping points specified on the drawing (if applicable).

4.9.2 General casting tolerances 3D scanning

Unless otherwise stated on the drawing or agreed between Gietburg and supplier the applicable overall tolerance for the component comes from the CT standard* as specified on the drawing in accordance with ISO 8062-2, based on the space diagonal of the 3D model of the casted part, including draft, according to following formula in millimetres:

$$Form \cdot tolerance = \frac{\sqrt{(lenght^2 + height^2 + width^2)}}{3}$$

Example:

Casting length: 600 mm
Casting height: 300 mm
Casting width: 200 mm

$$\frac{\sqrt{(600^2 + 300^2 + 200^2)}}{3} = 233{,}3mm$$

According CT10 nominal size 233,33 gives a tolerance field of 4 mm => Form tolerance ± 2 mm

4.9.3 Clamping points (zero points)

Unless otherwise tolerated on the drawing or agreed between Gietburg and supplier the following tolerances are applicable for the 3-2-1 points or zero points that are either stated on the drawing or agreed between Gietburg and the supplier.

CT Norm	8	9	10	11	12
Perm. Tol.	±0.5	±0.75	±1	±1.4	±2.1

If the component in the BestFit alignment is on the whole OK and the 3-2-1 clamping points are within the permissible ranges the component is OK. If the 3-2-1 clamping points are out of tolerance while the remainder of the component meets the specification the 3-2-1 clamping points must be corrected in the pattern or the values of the 3-2-1 clamping on the 2D drawing will be changed

* for drawings where tolerance is stated to GTB standard the same principle applies.

4.9.4 Separate tolerances

Separate dimensions are defined on the drawing. These area's shall be evaluated separately to the respective tolerances.

4.9.5 80% rule

In order to ensure process reliability in all evaluations, flags must only be set at points where the permissible tolerance is used by more than 80%. If points on the part exist where more than 80% of the permissible tolerance is used, a brief explanation on the report is required.

4.9.6 3D scan report requirements

Minimum requirements for 3D scan report:

- All areas of the casting should be clearly visible on the report
- Every pattern imprint must be documented
- A min. off 8 colour spectrum must be used to cover the full tolerance range
- Measured value for separate tolerances (e.g. wall thickness) need to be stated on the report
- Casting tolerance used
- Cast date of scanned parts
- Modell imprint number (if applicable)
- Part number
- Drawing number index
- Flags according to 80% rule (see paragraph 4.9.5)

4.10 Dimensional results initial sample machined castings

To ensure that a machined casting meets the dimension specification according to drawing the supplier must submit a dimensional report for each initial sample ordered. Each dimension should be stated with the specified tolerance and measure value. Each dimension should correspond to the numbered drawing (see paragraph 4.7)

4.11 Part Submission Warrant (P.S.W.)

Submission of samples and their documentation must always be accompanied by a Part Submission Warrant, according to the AIAG PPAP manual 4th edition.

412 Major or Critical dimension

3.12.1 Process Control (S.P.C.)

All product characteristics shall be met as per specifications. However, the characteristics that are critical for the function (KC) require special consideration since any associated deviations may result in failure or cause problems during assembly. A capability study (S.P.C.) for these dimensions is therefore necessary. Study's must be conducted in accordance with the AIAG SPC manual 2nd edition. In case of specific requirements these will be communicated to the supplier by Gietburg.

4.12.2 Measurement Systems Analysis (M.S.A.)

If a M.S.A. is required this must be conducted in accordance with the AIAG MSA manual 4th edition.

4.14 Approval Initial Samples

The products are approved by Gietburg for subsequent delivery. Approval does not absolve the supplier / contractor from the obligation to maintain the specified quality characteristics. Serial production shipments without approval remains to the risk of the supplier. Gietburg will sign off and return the signed P.S.W. by email to the supplier as evidence that the sampling process is done according to specification and the results are satisfactory for Gietburg B.V. the signed document is a valid release for production to the supplier.

5 Packaging & Labelling

5.1 Identification of initial samples / prototype samples

To prevent mistakes, ID-markings for PPAP samples must appear on the component itself and on the exterior of the packaging. The packaging has to be clearly visible and unmistakable identifiable as prototype or initial sample delivery.

5.2 Identification of series delivery

To prevent mistakes, ID-markings must appear on the exterior of the packaging. Labels must be unmistakable and clearly visible. To prevent confusion, old markings, remains of old labels etc. must be removed from load carriers. Position of the label according to fig. 1.

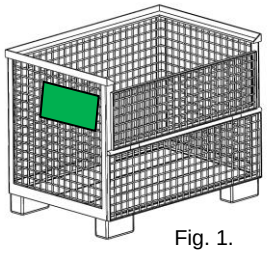


Fig. 1.

Labels must contain at least following information:

Foundry	**Machining**
Casting part number	Machined or assembled part number
Casting date	Quantity
Quantity	

*Above mentioned information has also be visible on the label in bar code (code 128)

5.3 Protection of goods and packaging

Parts must be packaged in a manner which is suitable for the method of shipping to be used and which provides protection against:

a) corrosion
b) contamination
c) damage (especially to machined surfaces)
d) bending or breakage

Packaging should be selected to allow stack ability of the individual packages. This means that components must not protrude over the top of the load carrier. If the goods protrude over the side, suitable collision prevention must be provided. If cardboard boxes are used, the boxes must be stable enough to ensure safe storage and individual withdrawal of components even when the transport protection has been removed.

5.4 Packaging instructions

If applicable, packing instruction will be provided by Gietburg

6. Gietburg Supplier Cockpit (GSC)

The main aspect of the supplier assessment at Gietburg is monitoring the quality performance of the suppliers in series and in collaboration with supplier address structure quality issue's.

The assessment is based on the Gietburg Supplier Cockpit (GSC) that will be send to the suppliers at regular intervals. In the suppliers are rated with the help of 4 Key Performance Indicators (KPI):

- PPM rating
- Logistics On Time Delivery (OTD)
- Purchasing (> 2016*)
- Development (> 2016*)

These KPI are used by Gietburg for rating and classification off its suppliers. With the cockpit the supplier can judge his performance for himself at any time and implement these into continuous improvement projects.

If systematic or repetition failures are identified, the supplier will be invited / visited and suitable measures are established together. The supplier has to report about the progress of the measures at set intervals.

6.1 PPM rating

For implementation of the "Zero Defect Quality", Gietburg and supplier agree measurable goals for the quality supplied. The contractually fixed PPM agreements per year [01.01.xx – 31.12.xx] are to be regarded as part of the continual improvement process (CIP). Failing to meet the agreed target can lead to a contractual fine, as agreed in the quality agreement (doc. QA-001).

PPM Calculation method:

$$\frac{\text{Number of defective parts per year X 1.000.000}}{\text{Number of parts received}}$$

Parts will only be include into the PPM rating after approval of initial sample. Excluded from PPM rating are initial - and prototype samples.

6.1.1 Definitions

PPM: parts per million = Number of defective parts per million parts supplied

Defect: means any occurrence when a supplied part has a defect in material and/or workmanship and/or fails to meet the technical specification agreed upon between Gietburg and the supplier and/or deviates or does not comply with the other technical documentation agreed between the parties which describes the shape, function, material content and/or any other requirement of the supplied part.

*year of implementation

6.2 PPM target

We expect our foundry suppliers to be committed to a zero defect approach. For foundries the following criteria are valid:

- A status supplier castings < 2.500 ppm
- B status supplier castings ≥ 2.500 ≤ 5.000 ppm
- C status supplier castings > 5.000 ppm

We expect our machining suppliers to be committed to a zero defect approach. For machined parts the following criteria are valid:

- A status supplier machining < 50 ppm
- B status supplier machining ≥ 50 ≤ 500 ppm
- C status supplier machining > 500 ppm

6.3 OTD target:

For OTD the following target is valid for foundries. Deliveries with ± 10 days of requested delivery date have to > 80%

7 Work plans

A work plan provides part specific detailed information about the production process of a casting in the foundry. Work plans are divided into 4 steps:

1. Core making (if applicable)
2. Foundry
3. Grinding
4. Final Inspection

7.1 General information work plan

The following information should be stated on each work plan

- A work plan should include at least:
- Casting number
- Drawing number
- Index of drawing
- Material
- Drawing revision
- Date first revision
- Date last revision
- internal foundry number (if applicable)

1. Work plan cores

A work plan cores should include at least;

- Picture of the core box(es)
- Picture of the finished core
- Weight of the core(s)
- Type of core(s) (e.g. cold box / Co2 / hot box)
- Information about coating of the core(s)
- Specified drying time of the core(s)

2. Work plan foundry

A work plan foundry should include at least;

- Picture of the pattern plate
- Pattern size and mould height
- Number of cavities / imprints
- Number of exothermic and / or feeders used
- Weight of casting including gating system
- Number of ingates
- Ladle size and minimum rest iron not poured
- In case of ductile iron : min.rest Mg guaranteed in last poured mould out of ladle
- Pouring temperature with allowed tolerance
- Mould filling time + downsprue diameter
- Minimal time before shake out
- Picture of the casting and gating system
- Weight off the actual casting
- Filter (if applicable)
- Heat treatment yes/no

3. Work plan grinding

A work plan grinding should include at least;

- Picture of the casting before grinding
- Type of shot blasting that is used (drum/hang)
- Tool(s) used to remove gating system
- Specify visual checks during grinding
- Specify area's that will not be grinded with max. deviation that's allowed.

4. Work plan final Inspection

A work plan final control should include at least;

- Chemical composition acc. to specification on drawing
- Tensile strength acc. to specification on drawing
- Elongation acc. to specification on drawing
- Material hardness acc. to specification on drawing
- Area where hardness is measured
- Sample size in series

8. Complaint management

8.1 8D-Report

The supplier is obliged, as far as possible, to react without delay to the complaint sent to him, by means of an 8D report upon request by Gietburg.

In any case a statement of the supplier regarding the implemented improvement measure is expected.

8.2 Firewall

Immediately after the occurrence of the failures the supplier must ensure that all stocks

- at suppliers / (sub)contractors
- in transit
- at stock at Gietburg

are checked 100% for the characteristics noticed. The aim is that no defective part shall get into Gietburg. If systematic or repetition failures are identified, the supplier will be invited / visited and/or audited and suitable measures are established together. The supplier has to report about the progress of the measures at set intervals.

8.3 Inspection and Claims

The quality inspection of delivered goods will be made according to the Gietburg requirements. In the case of defects in goods, Gietburg will issue documents showing the stated defects and will put the defected goods at the sellers disposal if requested.

8.4 Supplier concession request

For Gietburg, no product deviations will be accepted that affect fit, form, function, without written approval. Supplier Concession Request is the written request from a supplier:

- to know that manufactured parts, which in some way, do not conform exactly to specification / requirement or show deviations for running business parts.

- to ask Gietburg to accept and use parts already made / in transit / in warehouse which do not conform exactly to specification, and which the supplier has only become aware of after manufacturing.

Applicable documents:

QA-005 8D Report

Supplier Concession will only be considered for a specific quantity of parts or a specific time frame, and must always be in writing. It is not applicable for PPAP / initial sample parts as these parts shall be first time right.

Concession elements shall include relevant data such as:
Supplier name, location, contact numbers/data.

- Supplier personnel (name/position and contact details) responsible for handling deviation/concession
- Part number and engineering level
- Description of non-conformity / deviation with suppliers opinion of the effect on fit, form, function. OK/NOK and affected parts quantity / time frame.

9. Traceability

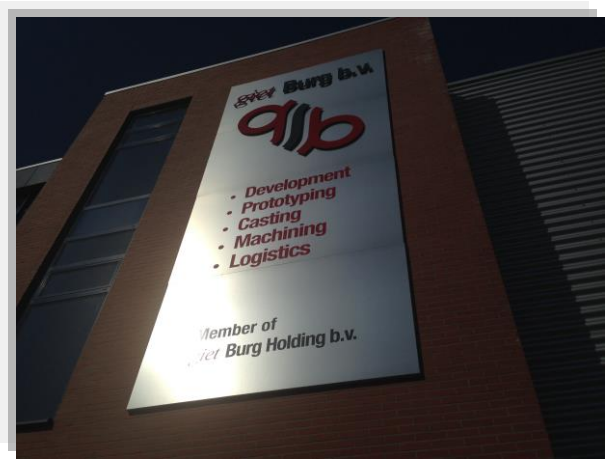
The supplier is obliged to ensure the traceability of the parts supplied by him. By identification marking and traceability of the products, or alternatively other suitable measures, the supplier ensures that in the event of a defective product all further possible defective products can be identified without delay in order to keep the subsequent damage as low as possible and if necessary to be able to call back the affected products. Beyond that these products are put on stop until follow up actions are agreed between the supplier and Gietburg.

The identification marking of the products is done, for example by applying a barcode or similar marking. For this identification all quality relevant data for the product are to be recorded and assigned. With the aid of the recorded data for example the following must be ensured:

- All manufacturing data, inspection and test results (actual values) must be able to be assigned to the product
- All defective products must be able to be isolated.

The data which must be recorded to ensure the requirements are to be specified by the supplier on the basis of his know-how with regard to his product and his processes.

Visiting / Contact List



Street address:	Segment 5 - 7
ZIP/postal code:	6921 RC
County/district:	Duiven
State/province:	Gelderland
Country:	Netherlands
Latitude, Longitude:	51.966, 6.013

T +31 (0) 485 343 292
F +31 (0) 485 341 410

Contact List

Quality Gietburg
Quality@gietburg.nl

General enquiries
Info@gietburg.nl

For more information please visit http://www.gietburg.nl